Ecological Flows Science Advisory Board (EFSAB)
Meeting Summary – April 24, 2012
Stan Adams Training Center, Jordan Lake State Forest, Chapel Hill, NC

X APPROVED for distribution June 19, 2012

Attendance

Members
Donnie Brewer, Environmental Mgt Commission
Bob Christian, East Carolina University
Tom Cuffney, U.S. Geological Survey
Linda Diebolt, Local Governments
Chris Goudreau, NC Wildlife Resources Commission
Jeff Hinshaw, NC Cooperative Extension
Jim Mead, NC Division of Water Resources
Sam Pearsall, Environmental Defense Fund
Judy Ratcliffe, NC Natural Heritage Program
Jaime Robinson, NCAWWA-WEA
Fritz Rohde, US National Marine Fisheries Service
Jay Sauber, NC Division of Water Quality
Bill Swartley, NC Division of Forest Resources

Alternates
Cat Burns, The Nature Conservancy
Peter Caldwell, USDA Forest Service
Vernon Cox, NC Department of Agriculture
Sarah McRae, US Fish & Wildlife Service
Steve Reed, NC Division of Water Resources
Van Stancil, NC Wildlife Resources Commission
Fred Tarver, NC Division of Water Resources

NC Division of Water Resources
Don Rayno
Sarah Young

Guests (Onsite)
Carolyn Bach, City of Raleigh
Fred Royal, Brown &Caldwell

Guests (Online)
Allisa Bierma
Haywood, LNBA
Steve Kroemer
Dan McLawhorn, City of Raleigh
Ian McMillan, NC Division of Water Quality
Kimberly Meitzen
Amy Pickle, Environmental Management Commission
Herb Vanderberry, NC Farm Bureau

NCSU Cooperative Extension Facilitation Team
Mary Lou Addor, Natural Resources Leadership Institute (NRLI)
Patrick Beggs (WECO) Watershed Education for Communities and Officials
Christy Perrin (WECO) Watershed Education for Communities and Officials
Nancy Sharpless, Natural Resources Leadership Institute (NRLI)

The purpose of the Ecological Flows Science Advisory Board:
The Ecological Flows Science Advisory Board will advise NC Department Environment and Natural Resources (NCDENR) on an approach to characterize the aquatic ecology of different river basins and methods to determine the flows needed to maintain ecological integrity.

Presentations, reports, and background information about the E-Flows SAB are available at: www.ncwater.org/sab

The EF SAB will meet **June 19, 2012, 10:30 am- 4:30 pm** at the Archdale Building Ground Floor Hearing Room, located at 512 North Salisbury Street in Raleigh. Public parking is available at: **www.ncwater.org/Data_and_Modeling/eflows/sab/visitorparking.jpg**

The appendices at the end of the summary correctly reflect what was discussed at the April 24 meeting. Appendices 4, 5, 6, 7, and 8 were updated since the meeting. Please be aware that information can change every time a new data point (site) is added. The Analyses tab provides current information: http://ncwater.org/Data_and_Modeling/eflows/index.php?tabid=1&subtabid=6

I. Executive Summary

Below are highlights of the meeting summary sections.

IV. Update on Fidelity Testing:

Sam Pearsall provided an overview of the fidelity testing of the EFS stream classes, which the Environmental Defense Fund (EDF) has contracted Research Triangle Institute (RTI) to conduct. To date RTI has the data in hand and has done some analysis of how the biological data matches up with the 185 USGS gages and with virtual gages for which there are data. EDF has asked RTI to simulate the 185 actual gages because if those gages when simulated do not classify the way they classify in reality, there is no point in simulating 500 more. RTI is using NC Benthos data, DWQ Fish Community data, WRC Trout fish data, and National Heritage Program data. Sam felt that the data sets mentioned are the only data they could find that are consistently available from one end of the state to the other and that are available in such a form that they can be used.

Thus far, RTI has limited their use of data to that collected in catchments with impairment ratings of "good" or excellent". The EFSAB discussed the pros and cons of using the DWQ data collected at sites with ratings of impairment of "good/fair" in addition to those with "good" or "excellent", in order to increase the number of catchments, especially in the piedmont. Sam indicated that he thought they would have enough catchments, but would share with RTI the possibility of using catchments with "good/fair" ratings.

The EFSAB also discussed the appropriateness of using DWQ's "swamp" data, at least for the work RTI is doing, as a way to enhance the data available for the Coastal Plain, which is somewhat sparse.

September 30, 2012 is the anticipated completion date for the contracted work.

Tom Cuffney is going to do an independent cluster analysis and an analysis of similarity to look at the community in total and how it corresponds with the classes as opposed to species by species. Tom has not yet received all of the data.

VI. Analysis of Habitat Modeling at Four Sites

After Jim Mead reviewed the basics of habitat modeling, the EFSAB divided into four groups to analyze a packet of material, each packet for a newly modeled site. Each group was asked to assess:

1) For each site contrast between small WUA and not small, and assess how that influences the comparison of different flow scenarios and whether a scenario is desirable or not.

2) Comparing the 15 flow scenarios by season, are there any conclusions you can draw?

3) Each group has a bar chart for less than 80% and one for greater than 120%. Do these charts show the same trend? Does one tell more than the other? Does that change your thinking about what scenarios are useful?

4) Are particular guilds most frequently affected at that site, and does that hold true for each season?

VIII. Report-outs and Large Group Discussion from the First Session of Small Group Work—Assessing Four Sites by Season

Summary of Responses to 4 Different Sites by Season			
1. For each site contrast between small weighted usable area (WUA) and the not small, and assess how that influences the comparison of different flow scenarios and whether a scenario is desirable or not.			
Group 1- First Broad lower (Judy) **Small Stable (Class B)**	**Group 2-First Broad upper (Chris)** **Small Stable (Class B)**	**Group 3- West Fork Eno (Linda)** **Small Flashy Class D**	**Group 4 – Tar River Louisburg (Bob)** **Small Flashy Class D**
Might still be important to address small wua because it might influence decisions later (no firm decision about this)	Some small habitat guilds or species that occur for a point in time (intermittent species/habitat) may not be as important. Varies by season in the small WUA groups. Keep analysis. <80% chart- the size of those striped portions was consistent across- the size of the solid bars get smaller to the right of the groups of scenarios.	WUA not informative for some scenarios, but extremely important for % in flow as flow by - recommend to keep to indicate impacts on particularly sensitive habitats and species at <80%. Similar to others about 7Q10 it's not that useful but it is for the other scenarios. >120%, showed little impact or differences for the scenarios, whether it was dealing with the WUA or otherwise on triggering of the habitat availability.	Stripes vs solids- the shallow fast guild more affected amongst the small usable group (WUA) in all seasons but others only during some seasons. Category of being minor in terms of area is seasonally dependent, even in season, only a few guilds.

2. Comparing the 15 flow scenarios by season, are there any conclusions you can draw?			
Group 1- First Broad lower (Judy) **Small Stable (Class B)**	**Group 2-First Broad upper (Chris)** **Small Stable (Class B)**	**Group 3- West Fork Eno (Linda)** **Small Flashy Class D**	**Group 4 – Tar River Louisburg (Bob)** **Small Flashy Class D**
Scenarios to the furthest right of each grouping (monthly median flows, higher % avg flows in stream) have least impacts. May be able to drop the scenarios towards the left that illustrate more substantial change in habitat. In looking at <80 or >120, same conclusion.	Looking at <80%, the only scenarios that show good results- monthly median and high % flow by. All others are 30% or more, up to like 95% of the guilds or species are being impacted. >120% keep separate from <80%	Very different on comparison of <80 & >120 >120% scenario shows little impact of different scenarios on habitat availability (does not tell us much). Consider more runs of flashy streams to learn more.	Major point- % inflow as flow-by, the category had the minimal impact at the higher levels of that category (80-95%)
3. Each group has a bar chart for less than 80% (<80%) and one for greater than 120% (>120%). Do these charts show the same trend? Does one tell more than the other? Does that change your thinking about what scenarios are useful?			
Group 1- First Broad lower (Judy) **Small Stable (Class B)**	**Group 2-First Broad upper (Chris)** **Small Stable (Class B)**	**Group 3- West Fork Eno (Linda)** **Small Flashy Class D**	**Group 4 – Tar River Louisburg (Bob)** **Small Flashy Class D**
Gut level reactions- the <80% graphs were more influential in analyses of flow scenarios.	Limited ability to recommend. >120% did not offer much Recommend keep separate because added to < 80% actually brings some right-end scenarios up.	<80%, the amount of habitat area changes seasonally but relative differences stay about the same. There is general consistency across the seasons and the amount of area per guild is noted. Seasonality is important to continue to parse out.	<80% larger withdrawals, larger impacts >120%, found either humps or plateaus, impacts more common at intermediate flow regimes than the <80%. at lowest flows <80% more concerns but at intermediate >120% more common

4. Are particular guilds most frequently affected at that site, and does that hold true for each season?			
Group 1- First Broad lower (Judy) **Small Stable (Class B)**	**Group 2-First Broad upper (Chris)** **Small Stable (Class B)**	**Group 3- West Fork Eno (Linda)** **Small Flashy Class D**	**Group 4 – Tar River Louisburg (Bob)** **Small Flashy Class D**
Deep guilds most frequently affected at this site, consistently lower habitat availability under each scenario. Little seasonal variability. Shallow high velocity had increases in habitat.	Addressed in 1	80%- more impacts in shallow guilds. Some seasonal differences with traditional flow scenarios, shallow guilds deeply impacted. % flow by had less impact on most species… >120, there is too little impact to compare the stream scenarios and seasons.	Focused on shallow-fast guild (tend to be darters); very rare in having very little habitat and being sensitive to changes in flow.

IX. Small Group Analysis of All Sites Combined, By Season: Instructions

The same four small groups were then provided with a packet for all sites combined, each packet for a different season. The groups were asked to answer the following questions:

1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?
2. Compare the 15 flow scenarios. Any broad conclusions?
3. Compare <80% and >120 % tables. Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?
4. Since these packets include separate charts for the 11 shallow and for the eight deep guilds/species, assess, for your season, the significant differences between these.
5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep versus 11 shallow?
6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get a different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

X. Trial Balloon

Before having the small groups report out again, DWR presented a Trial Balloon, which proposed some scenarios (of the 15 that the EFSAB has been looking at) that could be eliminated from consideration at this point. The proposed scenarios to keep or eliminate varied by season. The EFSAB divided into small groups again to assess the proposal from the perspective of the season that small group had previously assessed.

NC Ecological Flows Science Advisory Board - DWR Trial Balloon - April 24, 2012

Notes: (reminders to the EFSAB)

- The approach(es) developed for determining ecological flows will be used as a screening tool in river basin models and plans.
- These models/plans will be used to assess water availability under current conditions and projected 20-year and 50-year water supply demands.
- Red flags raised by modeling/planning will allow water supply systems adequate time to plan for meeting future water needs.
- Specific project proposals and feasibility studies would still utilize site-specific studies to determine ecological flow needs.

Trial Balloon:

1. **Introduction:** At this point in the work of the EFlows SAB, DWR is proposing that we focus on a smaller set of flow options for consideration. More analysis and review is needed before the SAB can consider a single ecological flow proposal.

2. The habitat modeling results have so far examined flow scenarios for habitat indices that are less than 80% or more than 120% of the habitat available under an unaltered flow regime. The differences between flow scenarios are less pronounced for results above the 120% threshold, and we propose that we focus on habitat results that are less than 80% of unaltered levels for future analyses.

3. Since the ecological flow approach(es) will be used as a screening tool for planning, it is preferable to establish criteria that if in error, are on the side of ecological flows that are slightly too high – a "false positive". Ecological flow criteria that are too low ("false negatives") are undesirable because if there is an error that is discovered during a site specific study for a proposed project, there would be much less lead time remaining for a water system to develop options to meet increasing water supply demands.

4. The table below indicates which of the 15 flow scenarios analyzed so far, by season, should continue to be evaluated.

Trial Balloon 4-12-2012

FLOW REGIME	Spring Apr-Jun	Summer Jul - Sept	Fall Oct - Nov	Winter Dec - Mar
Minimum Flow				
Annual 7Q10				
Monthly 7Q10				
September Median		KEEP	KEEP	
Monthly Median	KEEP	KEEP	KEEP	KEEP
Percentage of Mean Annual Flow				
10%				
20%		KEEP	KEEP	
30%		KEEP	KEEP	
40%	KEEP	KEEP	KEEP	KEEP
50%	KEEP	KEEP	KEEP	KEEP
60%	KEEP	KEEP	KEEP	KEEP
Percentage of Inflow				
70%	KEEP	KEEP	KEEP	KEEP
75%	KEEP	KEEP	KEEP	KEEP
80%	KEEP	KEEP	KEEP	KEEP
85%	KEEP	KEEP	KEEP	KEEP
90%	KEEP	KEEP	KEEP	KEEP

XI. Report out of Small Groups, all Sites Combined by Season, and Trial Balloon Assessment

Summary of Responses to All Sites Combined, by Season			
1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Combined without being overly concerned of WUA	Smaller proportion of shallow guilds were made up of small WUA; as move from left to right, lookingat the scenarios, the large WUA drop out.	Important to keep breakdown in.	Deep affected more than shallow; low WUA more sensitive than non-low WUA

2. Compare the 15 flow scenarios. Any broad conclusions?			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Remarkably comparable to spring	most scenarios – the deep would not make it	About seasonality	Do not know flows; 70% as flow by may be less than 60%; include some average flow
3. Each group has a bar chart for less than 80% and one for greater than 120% (only in the whisker plots). Do these charts show the same trend? Does one tell more than the other? Does that change your thinking about what scenarios are useful?			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Can make reasonable recommendation of <80. Might keep >120 because don't know yet what will find at other sites.	Comparing trends of <80 >120, trends – shallow similar; deep not	For Fall, the deep water preference guilds probably not worth doing. However, the shallow water guilds showed a little more definitive results for these guilds. Significant difference between streams within class For habitat impact, at or below 80%, all of the analysis were going to be useful and they should be retained.	>120% effects were far less predictable than the < 80% effects, especially at the smaller flow alterations. The effects of 120% can be much greater than the less than 80%, at least for the shallow group and not necessarily for the deep group.
4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
More refined analysis might support stakeholder processes later on. Feel that EFSAB can make reasonable recommendation	For the shallow guild group, the shallow fast guilds were fairly consistently contributing to a good portion of the height of the bar. that would be the blue, orange, and olive green. On the deep guilds, no obvious stand out.	None – disproportionately (leave all in)	Fish seemed to be more sensitive than invertebrates in the shallow group. Deep guilds more impacted by small alterations for flow, but shallow guilds more impacted at larger alterations in flow.

5 . Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep guilds/species versus 11 shallow guilds/species?			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Some preference scenarios be the same	8 deep appeared to be more sensitive to flow than shallow	Deep guilds less impacted to management than shallow; looking at <80, different for different streams	Varied season
6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get a different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Difference in some	Only 4 data points, reserve judgment	Too soon to consider this question	Reservation on classes – small flashy

Summary of Responses to the Trial Balloon Note: question 1 was the introduction			
2. The habitat modeling results have so far examined flow scenarios for habitat indices that are less than 80% or more than 120% of the habitat available under an unaltered flow regime. The differences between flow scenarios are less pronounced for results above the 120% threshold, and we propose that we focus on habitat results that are less than 80% of unaltered levels for future analyses.			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Some wanted to drop 120; others keep it.	Ok with dropping 120	Ok with dropping >120% and above because it didn't seem to have as much impact at the 80% or below.	Keep 120
3. Since the ecological flow approach(es) will be used as a screening tool for planning, it is preferable to establish criteria that if in error, are on the side of ecological flows that are slightly too high – a "false positive". Ecological flow criteria that are too low ("false negatives") are undesirable because if there is an error that is discovered during a site specific study for a proposed project, there would be much less lead time			

remaining for a water system to develop options to meet increasing water supply demands.			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
Is it better to err on the side of the bar being high or is that something else; do you have any initial thoughts on that? R: Something that came out…I was at a Wildlife Society Meeting in Athens last week and they were talking about ecological flows, climate change, and environmental services. One of the things that just came up was if the bar is high, if the environmental flow is such that it puts communities into a panic, this may increase the need for building more reservoirs. Meaning if we need to maintain this level of flow, we will need a reservoir to do it since a withdrawal scenario will not provide it. What can we take from this discussion? Anything precautionary we need to be mindful of? C: I think Jim covered it well when he talked about this being a screening tool. Being set too high simply kicks you into another site-specific mode. It's a whole lot cheaper to pump water into another lake than it is to try to build the eco system (or reservoir). C: By setting the 80% boundary, in a way you have already established to some extent what that policy's going to be. I don't think we really had that discussion, but good to throw it out there. Does that mean that there's still a lot of wiggle room between that zero to eighty. R: We haven't set it to zero; we haven't set it to a 30% change.			
4. The table below indicates which of the 15 flow scenarios analyzed so far, by season, should continue to be evaluated.			
Group 1- Spring (Judy)	**Group 2-Summer (Chris)**	**Group 3-Fall (Jeff)**	**Group 4 – Winter (Bob)**
satisfied with the level of change, as far as the keeps.	Leave as is	agree with the recommendation of the ones to leave out for the fall, which were the two median flows and the 10%. Analyze 7Q10 later in the analysis	For winter itself-acceptable.

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II. Welcome, Introductions, & Meeting Orientation

The facilitation team welcomed the NC Ecological Flows Science Advisory Board to the 12th meeting. Everyone attending the meeting, in person and online, introduced themselves and their affiliation. The EFSAB was reminded about the ground rules, the process for raising questions, and to speak into the microphone (and/or project clearly) when contributing to the discussions. Everyone was reminded that the session was being recorded.

The remaining 2012 meeting dates and meeting locations are listed below and posted online at www.ncwater.org/SAB. Whenever possible, the NC Division of Water Resources will provide parking passes when the EFSAB meets downtown at the Archdale Building. Ample free parking is available when the EFSAB meets at the Stan Adams Training Center, located in the Jordan Lake Educational State Forest.

June 19, 2012 – Archdale Building
August 28, 2012 - Stan Adams Training Center, Jordan Lake Educational State Forest
Sept 25, 2012 - Stan Adams Training Center, Jordan Lake Educational State Forest
October 23, 2012 - Stan Adams Training Center, Jordan Lake Educational State Forest
November 27, 2012 - Archdale Building

III. Review of February 21, 2012 Meeting Summary

The February 21, 2012 Meeting Summary was distributed for a final review, is approved, and is posted on the DWR website. All approved Meeting Summaries of the EFSAB are located at: **www.ncwater**.org/sab

IV. Update on Fidelity Testing

Sam Pearsall provided an overview of the fidelity testing of the EFS stream classes, which the Environmental Defense Fund (EDF) has contracted Research Triangle Institute (RTI) to conduct. To review, EDF contracted with RTI to do fidelity testing to see: 1) if the EFS classes have any biological reality, if the classes are biologically distinct; and 2) if not, to see if there is any readily available way, such as using eco-regions or physiographic regions or some other regionalization of the state, to parse those classes or subdivide them such that they do have biological reality. An outcome could be that they do not, which would still be informative. The goal is to ask the question.

The project involves a two-step test. In the first step, they are going to look at the 185 USGS stream gages with 18 or more years of continuous data that were relatively undisturbed (relatively unaltered flows). They are using four of the EFS stream classes and pairing them with data from the NC Benthos data set, the Division of Water Quality's (DWQ's) Fish community dataset, the WRC Trout dataset and Natural Heritage Program's (NHP's) dataset of vulnerable species.

The first thing RTI has found is that of the 185 gages, 22 do not end up classified or do not match up with data. Of the remaining 163 gages, 62 match up with NC Benthos data, 22 with DWQ Fish community data, 7 with WRC Trout data and 61 with NHP data. The distribution of the catchments in which those gages are found is fairly even across the state, except for the Coastal Plain. Fifty-two of the 185 catchments had "Good" or Excellent" site condition. EDF and RTI are continuing with the process, but they are not confident that they are going to have enough matching between data and the 185 sites to draw conclusions. The other thing that RTI has done is look at all the virtual gages in NC for which there are actual Benthos data with "good" or "excellent" ratings (based on benthos). Using the data from 1983-2006, there are 818 catchments that fit that description. Adding the 52 catchments linked to the 185 USGS gage catchments, gives 870 catchments with "good" or "excellent" ratings. The distribution of those is heavily biased toward the mountains, presumably a function of where the streams are wadeable, not a function of priority. EDF and RTI considered reducing the time period for which the gages would be evaluated, reducing it to 1996-2006 data. Using that data, they could still find 500 sites, but the distribution was even more heavily tilted toward the mountains. They opted to move forward with the 1983-2006 data set. Among the 870 sampling sites in that dataset, 870 match with NC Benthos data, 159 with DWQ Fish data, 206 with WRC trout data and 293 with NHP data. EDF and RTI are hopeful that if they simulate 870 gages, or at least some significant fraction of those, at least 500, and match those up with the four datasets, they may have some correspondence. Sam reminded the group that they are using simulated gages because the 185 USGS gages are not enough to successfully make the analysis. EDF has asked RTI to simulate the 185 actual gages because if those gages when simulated do not classify the way they classify in reality, there is no point in simulating 500 more. Essentially all we have at this point is the data in hand and some analysis of how it matches up. EDF has committed to USGS that they will deliver to them all the data. Tom Cuffney is going to do a non-class-based analysis to see if the data cluster independently of class.

Question: Can you repeat that?

Tom Cuffney: We are going to do an independent cluster analysis and an analysis of similarity to look at the community in total and how it corresponds with the classes as opposed to species by species.

Comment (C): Sam, in response to your earlier assumption regarding having a large number of those biological monitoring areas in the mountains, you made the decision to select just "good" and "excellent" locations. Clearly the piedmont of NC has a lot more impacts in it than most of our areas in the mountains. DWQ has made the policy decision to draw the line of acceptable, unimpaired water quality at a level below "good" or "excellent" and include "good/fair" as an unimpaired situation. If you added that category, I am pretty comfortable that you would have a larger number of sites with which to add to the piedmont and, perhaps, the coastal plain as well.

Response (R): Okay.

C: I agree with the process you are moving forward with, using "good" and "excellent", but if that is not successful and there is the possibility of gleaning additional help, then I think it would be acceptable to go to that next tier down.

R: I think we have an adequate sample, but I will suggest to RTI that that might be something to consider. We were responding to concerns expressed by this Board that we not get into impaired sites or sites where the flow is too seriously modified. As you can imagine, we are using variables to represent each other here quite a lot. If DWQ finds that a site is in pretty good shape, we are kind of

leaping to the assumption that between that and gage data, we can make some assumptions about how seriously the flow is altered. Those are assumptions.

Continuing with his presentation, Sam noted that one of the things he was asked to do was look at the list of questions that came out of the small groups at the last meeting and try to respond to them.

Q: Can I address the comment made earlier? I may be wrong, but regarding the decision about the ratings, do these ratings address abundance or is it just based on the assemblage?

R: I am assuming that the work that RTI is using is based on DWQ's ratings of IBI for a fish community. That includes a number of metrics: abundance, diversity, condition and other things. If they are using DWQ's IBI, there is about a half dozen different metrics involved in that assessment.

Q: So a site that is rated "good/fair" may still have pretty extensive biodiversity, it's just that the abundance may have shifted or some other metric may have shifted, and I think in the work that RTI is doing we are most interested in how many species are actually represented at a site, or no?

R: The way that RTI is analyzing it, they are using presence/absence, aren't they, or has that changed?

R: I think they are starting with presence/absence.

R: The problem is that as you go down the disturbance gradient and a species disappears, then you are picking up that water quality influence as something relating to the hydrology classification. The more you go down that water quality impairment, the greater variability you are entering into it. So you have the trade-off between increasing the ? and decreasing the probability that the species is there if it happens that it is something not tolerant.

R: Yes, and keep in mind that only 20% of these locations have fish community data.

R: That's right. Of the 870 sites we could use, 870 of them have benthic data; 159 of them have DWQ Fish data; 206 of them have WRC Trout data, and 293 have NHP data. Please keep in mind that our goal here is not (as much as we would like to do it) to biologically characterize the rivers and streams of NC. Our goal is to determine if our classification system is biologically real, which is an entirely different question, and if it turns out that our classification system is not biologically real, can we subdivide it such that it is. If the answer to that is "no", we have learned something important.

Q: Sam, can you go over the timeframe of the rest of the project with RTI?

R: Sure. That was one of the questions I was going to answer from the last meeting.

Continuing with his presentation, Sam indicated that September 30, 2012 is the anticipated completion date for this phase of the project, the only phase contracted for at this point. The next phase, where they would consider setting the classes using some sort of geographic strategy, is something EDF has not yet committed to doing. They think they probably will have to do it, and that would start October 1, 2012, assuming they go there and assuming that everybody stays on schedule and under budget.

Looking through the questions from the small-group discussions at the last meeting, there were a number of questions that Sam was not quite sure how to answer. There were also a number of questions about how the RTI WaterFALL model itself works, and Sam suggested that those questions be held until RTI is at an EFSAB meeting. A number of questions ask if EDF/RTI is experiencing significant data holes. With the simulated gages, assuming that the simulated gages can be used, the answer to that is no, they do not have any huge data holes. They are going to have a statistically adequate test. There were a number of questions about whether EDF/RTI were going to have enough unaltered or pristine or undamaged sites. The answer to that is that that is not really what they are shooting for. We are really shooting for a classification of the rivers and streams of NC as they are so that we can figure how to go forward from here. We are doing very

little looking back in terms of how things might have been or once were. Sam then suggested that the Board members look through the list of questions from the last meeting and see if there are any persistent questions they would like for him to answer.

V. Update on Fidelity Testing: Small Group Discussion

Facilitator: I made a list of the questions asked in more than one group during the Feb 2012 meeting. The most frequently asked questions were about: unaltered flow, timeline, reference sites, large river data, and other sources of data. (Reference Appendix 10 for the entire list of questions raised by the EFSAB regarding Fidelity Testing).

R: We are not really struggling with unaltered flow; we are struggling with streams that are the most representative of their classes. Actually, we have some filters we are using to drop the most altered flows. The first question on the list of questions is whether there is such a thing as unaltered flow to which Sam answered "I think, no". They are using the best they have.

Regarding whether there is enough data on large rivers, it is somewhat dicey. The simulated data will help with that. Regarding what other sources of data might be available, Sam felt that the data sets mentioned are the only data they could find that are consistently available from one end of the state to the other and that are available in such a form that they can be used. It had been suggested that EDF/RTI contact licensees about data that had been compiled for FERC relicensing. EDF/RTI decided not to do that because those data are collected from the most altered sections of streams, located immediately downstream from dams. There were a few other suggestions about data strategies that EDF/RTI could pursue; EDF asked RTI to look into them and for one reason or another, they opted not to use them.

C: Following up on what was said about the "good"/"excellent" ratings, if you look at the 52 catchments with "good" or "excellent" ratings (plus 3 NC reference sites), almost exactly half of those are in Class B streams. Remember Class B is labeled small/stable, which tend to be located in the western part of the state. So you get not only a potential geographic shift when you draw the line at "good"/"excellent" you may as well have a strong shift toward class B streams. That is something to keep in mind as RTI proceeds. The downside of also including the "good/fair" class is that you may insert some more altered water quality or hydrology or both.

R: There are two tests that I think we will run. One is to see if the 185 sites simulate into the existing classes. If they do not, we may have hit a wall.

There was then some discussion of what a certain table in a handout provided by RTI indicated, whether it showed a count of sites in each class with data available or whether it indicated the number of the 185 USGS gages falling into each class. If it indicates the latter that would imply that RTI has already simulated the 185 sites into the existing classes and that they line up really well except for class D. When simulating with OASIS data, DWR ran into the same thing because class D is that small/flashy and models have a hard time simulating day-to-day flashiness. There tends to be a balancing out, when calibrating a model to make the mass balance of water work, often dampening those upward or downward spikes that a real gage experiences. Sam agreed to investigate this. At any rate, step one is to figure out whether the actual gages simulate into the same classes or come close. The second step is to do the actual classification of the simulated data. If it turns out that when they do that, there are many sites in class B and a shortage of other classes, that will trigger expanding the data set to include "good/fair".

Q: The rating of "good/fair" does not necessarily result from altered flow. We are kind of mixing hydrology with ecology. Is there any way to sort out whether the impacts that might be responsible for placing a stream in "good/fair" are related to flow condition rather than some other factor. Is that noted in the fish data set, for example?

R: This index was designed and built to reflect DWQ's concerns as they relate to water quality. Some of those concerns are related to habitat, flow, chemicals and a number of other things. Our ability to discriminate our analysis strictly for flow is probably not a reasonable effort. Keep in mind that benthos are going to be representative of a temporal period of 6 weeks to 6 months, and episodes of flow during that time period also affect populations, but so do a host of other issues. The indices were not derived for purposes of evaluating changes in flow. In order to get there, you would be doing so with such uncertainty that the information would be misleading.

R: I think it is important to understand that relating biological response to water quality is a 45-year old science. Relating biological response to water quantity is what we are scratching at; we are trying to just get started on that. As a result, we are using a lot of surrogate data to represent things that we hope they actually do represent. It is incumbent on us to test our assumptions and be skeptical of our results as we move forward, but ultimately if we do not come up with some sort of rough way to do this, then we won't have anything to go on. Let's get a foundation, find out where it is not level and figure out where we need to do more work.

R: I agree. I think it would be wonderful to take DWQ's biological monitoring sites that have been monitored over decades and take the reference sites around the state, control the flow coming into those, then change those every couple of years to see what dynamics occur in the biologic populations, but I think this group will come to some conclusions before that is done.

C: I believe that in coming up with the 500, or tentatively the 870 virtual gage locations, RTI screened out sites with point source or surface water withdrawal locations in the catchment.

C: In talking with Jennifer (RTI) about what to do if the 870 does not give us the kind of coverage we want, one strategy being considered is to look at catchments that classify identically as adjacent catchments, and in the process pick up a lot more data sites.

C: Surrogates.

R: Yes, there are a number of strategies available to us, but they all involve a fair bit of inductive experimenting.

Q: I get the impression that bio-classification of "excellent" or "good" is strongly related to the small/stable and the piedmont large rivers.

C: Part of that is probably the wadeable/not wadeable bias, and part of that may be la function of fewer impacts that result in below "good" in the western part of the state .

Q: Is that bias going to be overcome by the 500 virtual catchments.

R: We don't know yet.

C: We already know that if we use the 870 NHD+ catchments with "good" or "excellent" site conditions in the data then we have strong bias toward the mountains, which means that we have a strong bias toward certain classes. What we are hoping is that in the process of looking at the 870 sites with data, we have enough coverage of the rest of the state that we can draw responsible conclusions. If we don't, then we may be able to use "nearest neighbor" or adjacent and end up with the same class and have data.

Q: If the classifications represent the hydrology as we know it...

C: The hydrology as we know it using the 185 gages judged minimally altered, with 18 years of data.

Q: I'm just trying to think about whether it is important for us to appreciate that the biology is also altered in the piedmont, and we have to be able to analyze classes with what we do have. If the majority of the biological situation we have in the piedmont is some level of impairment, we still need to be able to use the data we have collected to tie that to the classification.

C: Adding "fair" sites may be the way to get there.

C: Again, recall that we have made the policy decision that "good/fair" is not impaired, but that does not mean the same thing as unaltered.

R: Unimpaired is a water quality characterization.

Q: Really, "excellent", at any given time, does not necessarily mean unaltered either, right?

R: Correct.

C: It could be a physically heavily altered system. It's just a measure.

R: That's true. We present with imperfect knowledge.

C: True, but you could apply that uncertainty equally between those classes without violating the assumption. I just think we need to seriously consider the piedmont because quite a bit of flow alteration is likely going to be proposed for the piedmont eventually.

R: The piedmont is experiencing a great deal of flow alteration, and it is a biologically important place. I acknowledge both of those, and I accept the recommendation that perhaps we should include the "fair" class if we do not have adequate representation otherwise.

C: If adding the "fair" to the analysis increases the n, but the distribution of that n is still the same, we really haven't gained anything.

R: The distribution is going to show, I predict, the same spatial scattering, but I won't know that until I see it.

C: I am just saying that if it does, then in my mind, you would be adding data that has more uncertainty to it.

C: The "excellent" ratings may also carry that same level of uncertainty regarding flow. We don't really know. I agree with your premise that if it doesn't change the distribution, we should go forward as it is. We also need to know out on the table that the "excellent" classification, perhaps, carries the same level of uncertainty regarding flow as the others. We all tend to have a bias that it does not, but we do not know.

C: The question is, do we have enough sites (simulated and real gages) per class to test the class? That we will not know until we run the simulated gages through the classification software.

C: I guess one could go on record to say that while we worry about the piedmont being under-represented, I think the coastal plain has to equally be placed in that category.

C: Acknowledged and duly worried about. If we do not have enough sites to test coastal classes, we will have to come up with more sites.

C: I would also offer some cautionary statements in that the coastal plain also includes some swamp methodologies that DWQ uses for biological ratings, which are quite different from our other methods. They are typically done under a very narrow seasonal window that is indeed flow related. I would suggest that you avoid using DWQ's swamp data for this analysis. The problem is that as we are trying to relate these to hydrology, our data were not collected for that purpose in the swamps analysis.

R: The data were not really collected for hydrological purposes anywhere.

R: Correct.

R: But aren't we getting a species list? Some of the data being used by RTI is the species list, right? For each gage you are assembling a species list?

R: We are going to look at presence/absence data for organisms per class, and we are probably going to drop the outliers, such that if an organism only shows up once or twice in a class, or if it shows up in all classes those are organisms that probably would not be very important to the question of fidelity.

Q: Since none of the methodology is going to be the same among the datasets (benthic, fish, NHP), what is the significance of whether the swamp data is collected in the same way as the mountain stream data? How do we develop a list of species that we have presence/absence data for at a given gage? Isn't that the objective?

R: I am inclined to use the swamp data.

R: If you are using a species list, I don't have any problem with your using the swamp data. The species are there or not and you are using present/absent, I am good with that. But if you are screening those by just "good" or "excellent", we have other categories such as unimpaired that wouldn't necessarily show up in a "good" or "excellent" for our swamp waters.

R: That's what I am trying to get at. What we want is a species list. Wherever we can get a good species list...

R: Yes, they have all that data, and there is no problem with using the presence/absence portion of that analysis.

R: You understand that Tom's analysis is going to be much more sophisticated than presence/absence. He is going to start by looking at whether communities cluster out of the data.

R: Right. I think that is a very valid question as well, but I think for what RTI is doing we may be making presumptions on the front side about what "good" and "excellent" mean from a benthic classification, which we might not have to make. We may just need to look at what gages do we have the most data for regardless of how it was collected.

R: The whole purpose in using the "good" and "excellent" was simply to avoid the complications associated with other water quality problems. If you start including these other things in there, then the changes you are seeing may not be due to the classes, but may just simply be point sources or urban areas or all the other stuff. I am curious about all this discussion. With all the good part of it, nobody has asked the $6M question: How are we going to determine if it does or does not fit the classification? When you get all done with the fidelity analysis, what you will have is a list of species and a probability that species belong to a certain class, and in this indicator analysis, it is entirely possible to come up with no species in an indicated class. What criteria are we going to use to answer the question of whether the biological categories are matching with the hydrologic classification? Even in the stuff I am doing, the answer we will get will be that there is a certain probability that it is better than a random distribution. That's essentially what you will get with the individual species from the RTI analysis. You get a probability, but what is our criteria for that? Are we saying that if we have 80 taxa and 50 of those taxa align with a probability of 50%, does that pass?

R: So when the two strategies are implemented, I think what I hear you saying is that the critical question that we have to address as a group is, "Where on the cluster chart do we draw the line and say that represents the significant line?" I think this group is up to that task. Remember the only reason we even care about classes is because the DWR has strategies for looking at how altered flows affect habitat for the species and the guilds, and the question is whether we should have a different set of species and guilds and different sets of strategies for each of many classes so that we have class-specific methodologies, or are we going to have to do that for every river and stream in the state? Is it possible for the DWR to come up with a strategy for looking at impacts on ecological baseline on a class by class basis? That will save them a ton of work and get us a lot further down the road a lot faster if we attempt to avoid misusing the state's water. So, that's the goal. The goal is not that these classes should have any sort of grand utility beyond the ability to say whether we should use different strategies in different places to evaluate ecological integrity.

The group then decided to wrap up this discussion and receive another update at the next meeting.

The facilitator asked for an update from Tom Cuffney on the analysis he will be conducting. Tom indicated that he is still in the process of receiving the data. He will then be looking at the data set

to see if there are any taxonomic issues that need to be resolved on the invertebrate side. He will also do the community analysis.

VI. Introduction into Habitat Modeling Scenarios

The rest of the meeting is devoted to reviewing habitat results and small group discussions about those results. Jim Mead reminded the EFSAB that they had spent a lot of time in reviewing habitat models early on. Jim reviewed what metrics are used in the modeling and how they are calculated. He reminded the group that the analysis presented was developed using Index B, where Index B is a metric calculated during time series analysis to quantify and compare the effects of different flow regimes on aquatic habitat. It is calculated as the average of all daily habitat values between 10% and 90% exceedance levels. The daily habitat data are created by converting a daily stream flow record from the OASIS model, using the habitat versus flow relationship that comes out of the PHABSIM model.

First, the Index B value for the unaltered flow record is calculated to establish a benchmark, the denominator that is used to calculate all the percentages. Then the OASIS model is run with all the 15 different flow scenarios that the EFSAB chose to test at an earlier meeting.

A run of the Oasis model is conducted for the fifteen different flow scenarios the EFSAB settled on: the 7Q10, the monthly 7Q10, the different percentages of average flow, the different percentages of allowable withdrawal. The fifteen different flow scenarios are the numerator. The Index B for each of those scenarios is divided by the Index B for the unaltered flow record and converted to a percentage. During past discussions, the EFSAB thought that it would be good to identify the guilds or species where that percentage – the flow scenario divided by the unaltered flow scenario – was either less than 80% or more than 120%. Initially these were lumped together to get the total with significant effect. Later, a member suggested separating the profiles, to have a less than 80% differentially from those that have more than 120%. This was done in the data to be presented today.

The other suggestion was to incorporate a consistent set of 19 guilds and species. All of the sites have these same organisms evaluated (even though when conducting sites in the past for a specific project, there may have had some others thrown in there that were very specific to that site). With this idea in mind, the goal is to lump these together and determine if there are overall trends when multiple sites are amassed together. Thus, a common set of nineteen is the same for all completed sites. As of this meeting DWR had completed the modeling for eight sites. In addition to the sites already presented to the EFSAB (the Eno River State Park and the Buckhorn Creek site) DWR has completed six additional sites. Of the eight sites completed, four are small/flashy streams and four are small/stable streams.

VII. Small Group Assessment of Four Sites by Season: Instructions

With the plan to divide the EFSAB into small groups in order for each group to analyze the results of a different site, Jim presented the results from one site, the First Broad River, Middle site, in order to familiarize the EFSAB with what the groups would find in their packets. Jim noted that there are three sites (Upper, Middle, and Lower) on the First Broad River, spread by some distance on the river, with different habitat types. The first graph combines the results for all 15 scenarios, showing the 19 guilds/species with less than 80% of unregulated index B value on one graph (Appendix 1).

This has all four seasons on one graph, color-coded. This presentation incorporates suggestions made at previous meetings: 1) each season is weighted equally, not by the number of months in the

season (for example, looking at spring for Annual 7Q10, the stacked bar chart is created by dividing the Index B value at Annual 7Q10, for each of the 19 guilds, by the value for an unaltered scenario, then taking the number of those quotients (as a percentage) less than 80% and then dividing that number by 4 to create the stacked bar chart); 2) the striped portions of the bars are included to address the issue that for some species and guilds there is lots of habitat and for some there is very little, giving a small denominator, meaning that a small change in habitat can result in a large percent change; the striped portions demark the species/guilds that have an Index B value less than 1000 for their unaltered, benchmark denominator value (looking across species across sites, 1000 is a low habitat value); therefore, all the blue, whether striped or solid, is spring, but the striped portion is that percentage of the 19 guilds/species in spring that had less than 80% of the unaltered metric value, but did not have a lot of habitat.

In the packet for each site, there is a graph showing the guilds/species with less than 80% (Appendix 1) and one showing species/guilds with greater than 120% of unregulated Index B value. Additionally, the packet includes, for each season, tables showing the actual numbers that went into developing the bar charts, including showing which guilds have less than 80% habitat for each flow scenario (in one table [Appendix 2], over 120% in another) and indicating which of those had low weighted usable area (WUA) (shown as .01 in red in the table) and which had WUA over 1000. The actual WUA is also listed for each species in the yellow column. Finally, each packet included a table for each season that shows the actual percentages so that the EFSAB can see how much the percentage was less than 80% or above 120% [Appendix 3]. Any value less than 80% or greater than 120% is highlighted in yellow with red print. The intent is to be able to compare the 15 flow scenarios (the x-axis on Appendix 1). Each packet (one for each site) also includes an overview of how the graphs and charts were developed and a site description for the individual site (drainage area, the classification of the site, the number of cross-sections there at the site, and what habitat types were present in each cross-section).

The EFSAB and alternates were then divided into five small groups [then consolidated into four], each group to analyze a different site and assess the following:

The four questions posed to the EFSAB were:

1. For each site contrast between small weighted usable area (WUA) and the not small, and assess how that influences the comparison of different flow scenarios and whether a scenario is desirable or not.
2. Comparing the 15 flow scenarios by season, are there any conclusions you can draw?
3. Each group has a bar chart for less than 80% (<80%) and one for greater than 120% (>120%). Do these charts show the same trend? Does one tell more than the other? Does that change your thinking about what scenarios are useful?
4. Are particular guilds most frequently affected at that site, and does that hold true for each season?

VIII. Small Group Report-outs and Large Group Discussion: Assessing Four Different Sites by Season

The facilitator introduced the process for the report out of the small group discussions:

1. Each group will report out their responses to the four questions
2. Following the report out, the larger group can follow up with questions of clarification
3. The group is asked to table any larger group discussions until the end of the report out, when all groups have had a chance to contribute.

4. Conduct a synthesis of what we heard from the four groups.

The four questions posed to the EFSAB were:

1. For each site contrast between small weighted usable area (WUA) and the not small, and assess how that influences the comparison of different flow scenarios and whether a scenario is desirable or not.
2. Comparing the 15 flow scenarios by season, are there any conclusions you can draw?
3. Each group has a bar chart for less than 80% (<80%) and one for greater than 120% (>120%). Do these charts show the same trend? Does one tell more than the other? Does that change your thinking about what scenarios are useful?
4. Are particular guilds most frequently affected at that site, and does that hold true for each season?

Group 1: First Broad River – lower site, Class B (small stable stream)-- Judy reported.

1. In response to the first question about weighted usable area, our group did not come to a firm conclusion on this. However, it might still be important to analyze the small WUA part of it as this information might influence later decisions. Thus, we suggest continuing that level of analysis.

2. Comparing the fifteen scenarios by season, are there any conclusions you can draw? We thought for the vast majority of the time we want to continue to consider scenarios furthest right of these groupings. Therefore, the furthest right being monthly medium flows, some of these higher percentages of average flows remains in the stream, and thus the least impacts would be illustrated for each group to the right of the scenario (the trends). Presumably, at some point, we might be able to drop from consideration the scenarios more toward the left that consistently illustrate more substantial change in habitat.

We consider this for both the 120 or 80. Looking at either aspect…like seven…average 7Q10…Annual 7Q10 and Monthly 7Q10, sooner or later we should probably be dropping those scenarios from consideration if they consistently show this impact. They are really not going to be a viable threshold that we want to consider because they're some kind of universal level of impact. The ones that are the most interest to continue analysis would be these to the right. In our case, monthly medians, the 50% and 60% minimum flow as a percentage of average flow and then 80%, 85%, 90%, continue to consider those.

3. Given the charts for 80% and for 120% - do they have the same trends? In our case, no, while the trends may be the same, there are differences. There are profound differences between the 80% and 120% analysis; at a gut level analysis, the 80% graphs and the information in there were more influential in our analysis of these flow scenarios (certainly more influential than the 120% graphs).

[Meaning they showed more difference?] No – but if you're trying to decide about flow threshold or flow scenario that you wanted to see employed in a planning scenario, then we believed our area of concern was better represented by the 80%, the impacts where withdrawals resulted in less habitat. With the 120%, we felt going forward that the increase is not that important but the most important ones were the 80%. Particularly in a planning scenario – the 80% might offer more planning value.

4. Are particular guilds most frequently affected at that site and does that hold true for each season? In our situation, the deeper guilds had consistently lower habitat availability under each of these scenarios and not substantial seasonable variability. On the flip side, the shallow high velocity guilds actually had an increased habitat.

[That was the same for both?] It's not two different scenarios, it's the same scenario. Some have types increasing over 120% of the availability and some have types decreasing availability and if there's a decrease greater than 80%, then that's represented.

Questions (Q) or Comments (C) of Clarification:

Comment from Jim: If you look at the site description table there, only two transects represent the habitat site because it was pretty homogeneous in that part of the state. This was in Shelby, just downstream of Hwy 74; it's very deep, flat, sloped, sandy stream.

Group 2 - First Broad River – upper site, Class B (small stable stream). Chris reported.

This site is upstream about fifteen to twenty miles from the site Judy reported on.

1. In response to the first question about contrasting weighted usable area we discovered that we quickly got into responding to Question 4 at the same time. The way we approached answering that question was by first asking ourselves which, of the small guilds or species, are ecologically important? In part, the combo of depth, velocity and substrate is odd at this site; shallow slow coarse substrate doesn't happen intuitively together. Hence some small habitat guilds or species that occur for a point in time (intermittent species/habitat) may not be as important. Thus, it requires digging into each individual one. Before we got to what are the overall trends, we were kind of asking ourselves the question about "What is the percentage and ecological importance of some of the small guilds?" Some other ones like shallow, fast, high velocity riffle kind of things are very important ecologically. It is not like a keep 'em all or get rid of 'em all. It really does depend.

So our recommendation is to keep that analysis in process going forward because it's not just a simple answer. Now this was our less than 80% chart and generally the size of those striped portions of the bars are pretty consistent across. What you see when you compare scenarios is that the size of the solid bars gets smaller as you move to the right of each of those groups of scenarios. But within each of those small striped parts, the ones that are affected on the left side might be different than the ones that are affected on the right side so it's, again, you can't just throw 'em all out or not analyze it.

It does vary by season as well, which ones are affected or being counted in that small. Bottom-line, keep it but you've got to really dig down to understand it.

2. Comparing the 15 flow scenarios by season, are there any conclusions you can draw? Going back to the scenarios with the 80%, in our situation, the only scenarios that really show good results are the monthly median and those very high-end percent flow bars. All the other ones are 30% or more, up to like 95% of the guilds or species or being impacted. So at least in our situation we would definitely not want to move forward on most of the scenarios.

3. Given the charts for 80% and for 120% - do they have the same trends? We are limited in which ones could be recommended to continue to be looked at. If you go to the other, the more 120%, then this is very different results here. This greater than 120% really did not help us out a whole lot, which is different from the results that Judy talked about. We would not necessarily get rid of this but it does not help us a lot. We recommend keeping them separate, because this added into the less than 80% would actually bring some of those right end scenarios up. Therefore, it's good to have split out.

4. Are particular guilds most frequently affected at that site, and does that hold true for each season? Discussed guilds early in response to question 1.

Questions (Q) or Comments (C) of Clarification:

Comment: It is interesting to note that both reports were on the First Broad River but different locations and there is quite a difference, particularly for the 120%. The upper site had more shallow sandy ponds whereas the lower site had sandy runs. If you look at the upper versus the lower, there is quite a difference there for the different types of gradient--something to be aware of.

Q: Where is the gauge located that was analyzed to determine the classification?

R: DWR determines classification from the Oasis model for the Broad River. There are two gauges: one is kind of in-between these two sites and then there's one that's upstream or on the upper side. These two combined were what went into building the Oasis model.

Q: Did both sites give the same classification?

R: Hydrologically – yes.

Q: Then I wonder if the location of that information that is fed into the classification system would capture an actual difference of these two different sites.

R: There are two different flow records - one at approximately 140 square miles and at 220 square miles and they both gave the same classifications. There was not a break there, which is kind of interesting. But there was definitely a habitat gradient with those.

Group 3 – West Fork Eno River - Class D (small flashy shallow cobblestone run). Linda reported.

Our site is a small flashy stream, similar to the two sites already reported though those were actually small stables. Our group sees a big difference between our flashy stream and the two reports prior. The West Fork of the Eno is mainly the shallow runs and cobble or gravel stone stream at the sample sites.

1. For the first question, we looked at it from two standpoints, one at <80% and one at the >120%. What we found for our site was that the WUA was not very informative for some of the scenarios but extremely important for the percent of inflow as flow by. Thus, we recommend to keep this to indicate impacts on particularly sensitive habitats and species at <80%. We're seeing similarly to what has been stated by others for some of these scenarios, especially if you look at the 7Q10, etc., it's not that useful but it is for the other scenarios. When it came to the >120%, we found that, especially if you compare our 120% graph with graphs of the previous two streams, the small stables streams, our small flashy looks a bit different.

Hence, for question 1, for 120%, we found it showed little impact or differences for the scenarios, whether it was dealing with the WUA or otherwise on triggering of the habitat availability.

2. Comparing the 15 flow scenarios by season, are there any conclusions you can draw? When we compare the 120 scenario to the 80 scenario, we found that they are very different. The >120% scenario shows little impact of different scenarios on habitat availability (does not tell us much). Since we did not look at other small flashy streams, we're unclear if other streams would show more on this graph than this specific stream does. Perhaps if another analysis is run, differences may become evident, and thus there would be a significance relative to Question 2 – maybe all small flashy streams are the same, maybe not.

3. Each group has a bar chart for < 80%, and one > 120%. Do these charts show the same trend? For <80%, the amount of habitat area changes seasonally but relative differences stay about the same. There is general consistency across the seasons, and the amount of area per guild is noted. We raised the question, is seasonality important to continue to parse out? Our conclusion was, yes. Some scenarios show different seasonal responses that are likely important, whereas for other scenarios the seasonality is not as important.

4. Are particular guilds most frequently affected at that site and does that hold true for each season?

For the <80%, we found that there are particular guilds that are generally impacted, such as more impacts in shallow guilds than deep or other guilds across all seasons. There are some seasonal differences with traditional flow scenarios - shallow guilds are highly impacted. Anadromous species they show a strong seasonal component as expected. The percent of flow by scenarios have less impact on all guilds but particularly relatively less impact on shallow guilds. For the >120%, there's too little impact to compare for this stream scenario or for the seasons.

Questions (Q) or Comments (C) of Clarification:

C: Judy, your group found more impacts in the deep guilds; our group found more impact in shallow guilds.

C: Yes; that's true. This may be because of what Jim was describing that the actual on-site habitat for our site was typically under a natural flow regime that would be deep. Thus the impact of that change would be noticeable, whereas in the small flashy scenario, perhaps the greater representation is too shallow, meaning shallow deep can change to shallow and shallow changes to zero. A broad inference perhaps is you don't change from shallow to deep; you may change from shallow to zero and we may change from deep to shallow.

C: Just a quick comparison again between the two here. The upper First Broad is not as shallow nor as small but is a lot closer to the West Fork Eno than it is actually to the lower First Broad River. Moreover, this is the plus >120% for that one, and then the plus >120% for West Fork. We are not pointing out a lot of differences between scenarios nor a huge impact for any particular scenario. Although the First Broad Upper is not exactly the same, it is somewhat. There certainly may be difference when you compare this to the lower First Broad River. What's interesting is that of the two that look very similar, one's a small flashy and one's a small stable. Thus the small stables are looking more similar, or at least from our sample size of three, there's not a strong pattern there (with classifications based on hydrology).

At the same time, there's something else going on here that causes the two that are different classes to be more similar in their habitat response.

C: From the small flashy scenario, the general recommendation was until you've had enough sites to compare small flashies, you really couldn't throw any of these flow scenarios out until a comparison is made to ensure the results are not providing usable information.

Group 4 – Tar River (Louisburg) (small flashy). Bob reported.

Our site was the Tar River at Louisburg, also a small flashy stream. Our group spent the initially first 15 to 20 minutes wrestling with the meaning of the graphs. One of our conclusions is that the graphs embody a large amount of information that takes time to sort out and appreciate before reacting to them. Thus, we may have fewer comments than other groups (but we really know the graphs!).

1. With respect to first question and the stripes versus the solids, we found that our shallow fast guild seemed to be affected the most among the small usable group or the WUA groups, and this was in all seasons. What we discovered is that other guilds were only part of that group for certain seasons. Thus, the category of being minor in terms of area is actually seasonally dependent for our

situation, even at the season where these groups were most abundant, there were really very few of them so that perhaps only two or three guilds fell into that category.

2. Comparing the fifteen scenarios by season, are there any conclusions you can draw? Our major point was that the percent of inflow as flow-by category seemed to have the minimal impacts at its higher levels of 80-95%.

3. Given the charts for 80% and for 120% - do they have the same trends? Our response perhaps differs a bit from the other groups. As we heard with the other groups: in the <80% category, the larger withdrawals, the larger the impacts. For the >120%, we tended to find either humps or plateaus that you don't see in the sort of more monotonic changes with the other groups. What was interesting was with the >120%, the impacts were more common at the intermediate flow regimes than the <80%. Cannot recall if the other groups actually show that >120% actually had more of an impact at the intermediate flows, especially in the middle of that graph to the right, than the < 80%. So there are conditions where the > 120% can be more common than the < 80's.

4. Are particular guilds most frequently affected at that site, and does that hold true for each season? Again, we focused on this shallow fast guild. They tended to be garters. Those garters tended to be fairly rare in terms of having very little habitat and be very sensitive to changes in flow in flashy small or small flashy. The Louisburg is 10% shallow run; 20% runs with many snags; 20% run with one deep area (these are based on the various transects); 30% moderate depth pool; and 10% deep pool, so there's a fair number of shallow run areas. This may be the reason for the plateau; it increases in the middle, because as you bring things down you expose more shallow habitat.

Questions (Q) or Comments (C) of Clarification:

C: I'm glad we did this exercise; it allowed us to see that even if you compare two small flashy streams that have almost the same number of transects, there is not a lot of other differences. The graphs are significantly different.

C: Small flashies greater than one point.

C: Yes, a huge difference, and if you do the same comparison for the small stables – it might result in the same thing. Perhaps seeing the graphs being put on the screens months ago, you'd see it. But when you actually sit down and do this exercise, it really hits home a little harder that there are differences – dramatic differences for the small flashies.

C: My recollection of the channel profile of the Tar River and Broad River is that they have shallower types of profile than the West Fork Eno. For example, this is winter and one can see a lot of little red .01s there in the deep guilds. But there is very little deep habitat out there in the West Fork Eno with all the striped sections out there.

Q: Even with the Tar, there was a small flashy; don't you have more deeper areas?

R: There's still more deep areas in the Tar.

Q: Jim, how do those two sites compare just in terms of general flow characteristics? Besides the stream-bed characteristics?

R: Do you mean the site description?

C: The mean annual flow for the West Fork is 9.7; for the Tar, it is 438. Is a huge difference.

Other general observations, questions, and comments?

Q: What implications, if any, does this have for the fidelity testing if streams that are classified in the same way can have very different habitat present? Could this mean that the classification may not be representative of the biology?

R: What I found interesting is it mainly does suggest that there are, perhaps, some additional variables that, if we end up going with an approach that has a habitat basis for how you recommend to set up a flow regime for planning purposes, you'll be using a habitat for that; like the ? streams in terms of how the habitat responds. *From the small sample we've got now, the way the habitat responds doesn't necessarily line up with class.* But if you added some additional characteristics that sorted by class, then maybe it would line up. We can't sort by doing habitat studies everywhere; we all kind of understand the reasons for that, but it may be a gradient or something other than Jim Mead says the Tar River, Lower First Broad River, and such and such all need to be Class A, and West Fork Eno and Upper First Broad, they all need to be treated this way.

M: This gets to the approach Sam talked about at the Feb meeting; as you go through this, more than likely we're going to have to add other attributes to the classification system. We've got the hydrologic classification though we may need to add other components. You've got to have something to do with size or gradient or habitat to get at it since it's not just in the flow signature.

C: One other point to offer is that there are the less than 80% graphs for all…here's two of them and there's the other two. And while they're not identical, I'd say they're more similar than the plus 120's for all four sites, where you kind of had two of them being sort of like this and two of them, being sort of different. *Yes, the less than 80's aren't exactly the same but they are more similar.*

C: Two things. One, what we're really talking about here when discussing the difference between two graphs in the class, is a measure of sensitivity. Whether or not this stream is more sensitive than this other stream within the same class, assumes the class actually has meaning. Actually no; assuming that these two streams have different graphs, what we're really seeing, at least when we see that kind of profile, is the measure of sensitivity. I suspect those measures of sensitivity have a whole lot to do with the footprint of the river on the landscape. How large is the river spatially? So when X amount of change happens in flow, how much does the river fluctuate in terms of its footprint? This is my initial clearly untested hypothesis about what we see when we look at the <80's. When we consider the >120's, our hypothesis picks up steam. I think that the differences between the two 120's or the 120's within a class are almost certainly attributable to the size of the footprint on the landscape--something for us to contemplate.

Q: A quick question for Jim or anyone else that worked on those two sites. On the First Broad comparison between the two areas, is there a similar difference in the order of magnitude or meaning of flow as we saw with the small flash streams category? Or is that more similar?

R: They are more similar, the main difference between the drainage area is more than185 and the other is 220. Perhaps it might be double, but it's not on the order of magnitude.

IX. Small Group Assessment of All Sites Combined By Season: Instructions

Jim then reviewed what would be included in the packets for the small groups during the second break-out. This time the groups would assess all eight sites combined, each group looking at a different season.

Jim noted that at the last meeting there had been discussion of whether to focus on the shallow guilds, since, as Mary Freeman had suggested at the January meeting, the shallow guilds appeared to be the ones most responsive and most consistent from site to site. Someone suggested at the last meeting that it would be useful to graph the 11 shallow guilds/species separately from the eight deep guilds/species. Each group received two sets of plots and tables--one set for the 11 shallow guilds/species and one set for the 8 deep guilds.

Each packet (one packet/group for each season) included for each set (the 11 shallow guilds/species set and the 8deep guilds/species set) three different types of plots (Underlying all of these is the concept that for each site, for each flow scenario, there is a percentage of guilds with less than 80% of Unregulated Index B Value):

1) In the first plot [Appendix 4], each point represents a different site. For example, for spring season, shallow guilds, the Annual 7Q10 flow scenario, there is a point represented for each site; at the First Broad, Upper site, 100% (11 out of the 11 shallow guilds/species) had less than 80% of the unaltered habitat in contrast to the First Broad, Lower where only about 10% of the shallow guilds/species had less than 80% of the unaltered habitat. For each flow scenario, eight points are shown, each representing a different site. Some overlie each other. The small/flashy streams are represented by a shape (circle, square, diamond, triangle), whereas the small/stable streams are represented by linear symbols. Jim also added a mean line (showing the average for the eight sites). For this analysis, only <80% was included; >120% was not included in the packets.

2) The second type of plot [Appendix 5] is a whisker plot, as suggested at an earlier meeting. Instead of having eight symbols, these plots show the range for each scenario (the ends of the whiskers are the highest and lowest points for a given scenario), the quartiles for each scenario (although, admittedly, with only eight data points, quartiles are a bit rough), and the mean value (the black diamond). Whisker plots for both <80% and >120% were included.

3) The third type of plot [Appendix 6] is more similar to the plots used for the individual sites. In this plot, all shallow guilds/species at all eight sites are combined into one plot for a season. Looking at Annual 7Q10 for example, close to 55% of the shallow guilds/species had less than 80% of the habitat found in an unaltered state. The bar again shows which of those species/guilds had small WUA (striped).

To be able to assess whether there is a particular guild that drives the results shown in Appendix 6 (or the equivalent for each season), Jim also included a plot [Appendix 7, which shows spring] that breaks down the bars by guild/species. For each species, small WUA (striped) and larger WUA (solid) of each species/guild are represented if they were present. The maximum heights of each bar in Appendix 7 are the same as in Appendix 6. The plots like Appendix 7(one for each season) show which guilds/species are contributing most to the total percentage of shallow guilds/species that are less than 80% of unregulated Index B value for each flow scenario at all sites combined.

Finally, to be able to assess how the results differed by class (even though there are only four sites represented for each of two classes--small/flashy and small/stable), Jim included a bar chart [Appendix 8] in each packet (one packet for each season), showing for all 8 sites combined, the percentage of the 11 shallow guilds/species with less than 80% of unregulated index B habitat value, with separate bars for the small/flashy streams (shown in red) and the small/stable streams (shown in green) for each of the 15 flow scenarios. Again, the species/guilds with low WUA are demarcated with stripes. This bar chart allows for assessment of whether the trends are similar for both classes or not, and that may vary by season.

The summary tables for each class, for all sites combined, were also included in the packets.

Several questions were raised.

Q: What is the difference between fast and high velocity?

R: There are three shallow/fast guilds, but there is sort of fast, moderately fast, and really fast, so we have, using shallow guilds as an example, shallow/fast/low velocity, shallow/fast/moderate velocity, and shallow/fast/high velocity.

Jim then asked each group to assess similar questions as before, leaving out the former number 2 question (because it compared seasons) and adding three more, resulting in six questions.

Jim asked the groups to keep notes of their discussion and noted that DWR would present a trial balloon before the small groups reported out.

Q: What gets more emphasis on the second question: Whether we like the whisker plots compared to the other plots or the value of the 80% versus the 120%?

R: The 80% versus the 120% is a very helpful question for me because doing both requires more work for both you and me, but if you think the 120% is valuable, we will continue doing these.

After clarification of the task assigned to the four groups, the EFSAB divided into the same four groups as earlier, each group designated to assess one season, looking at all sites combined and responding to the six questions developed by Jim.

X. NC Division of Water Resources (DWR) Trial Balloon

After completion of the small group discussions to assess one season looking at all site combined, the small groups reconvened for an additional presentation and instruction by Jim.

Jim reminded the group of DWR needs for a visual tool to help develop river basin models and plans (it is not for a site-specific review and permitting). The trial balloon being offered at today's meeting is really more of an introduction to the rest of a proposal. With only eight data points, there is not enough information to say – this is our answer. DWR's proposal is however designed to consider a reduced set of alternatives, not one alternative but maybe not fifteen (somewhere between one and fifteen scenarios that the EFSAB could continue to analyze). Jim indicated that he would like to have the EFSAB respond to proposals #2 and #4 at this meeting. He asked that each member look at these proposals from the standpoint of the season his or her group looked at in the last break-out session, then the entire EFSAB will consider the questions from the standpoint of all seasons.

Jim passed out a trial balloon for the EFSAB to consider, noting that this would probably be the first of many trial balloons presented in this process. Before dividing the EFSAB into their small groups again to discuss the proposal by season, Jim noted that #1 under the Trial Balloon is not really part of the proposal, but rather more of an introduction.

Jim indicated that #3 is his proposal is an introduction to number 4. He suggested that members might not necessarily agree with what is stated in #3, and he would like feedback in terms of whether EFSAB members agree or not in terms of where to set the bar, ultimately, with some approach or set of approaches by class or by season. This proposal is to be sure not to set the bar too low. Because this is a screening tool, DWR would prefer to have a red flag go up before it needs to, to make sure that anybody expanding water use studies has enough lead time to make plans for their next water source. If the bar is set too low and used in water supply planning, everyone could be rolling along comfortably, then when faced with a site-specific proposal have the answer come up that they can't have that much water, then instead of having 10 years to figure out how to deal with the demand, they might only have five or less.

Number four shows a table, DWR's proposal by season. Looking at the Trial Balloon Table, Jim indicated that he left blank the scenarios that DWR felt did not need to be continued in future analyses, and he marked "keep" the ones that DWR felt should be continued in future analyses. Jim asked each group to go down the column under the season they had been looking at before, and decide if more should be kept, more should be dropped, or if this looked just right.

This is what the groups would be asked to report out on when the large group got back together. Jim emphasized that he is particularly interested in the small group's responses to proposals #2 and #4, and reactions to #3.

NC Ecological Flows Science Advisory Board - April 24 DWR Trial Balloon

Notes: (reminders to the EFSAB)

- The approach(es) developed for determining ecological flows will be used as a screening tool in river basin models and plans.
- These models/plans will be used to assess water availability under current conditions and projected 20-year and 50-year water supply demands.
- Red flags raised by modeling/planning will allow water supply systems adequate time to plan for meeting future water needs.
- Specific project proposals and feasibility studies would still utilize site-specific studies to determine ecological flow needs.

Trial Balloon:

1. **Introduction:** At this point in the work of the EFlows SAB, DWR is proposing that we focus on a smaller set of flow options for consideration. More analysis and review is needed before the SAB can consider a single ecological flow proposal.

2. The habitat modeling results have so far examined flow scenarios for habitat indices that are less than 80% or more than 120% of the habitat available under an unaltered flow regime. The differences between flow scenarios are less pronounced for results above the 120% threshold, and we propose that we focus on habitat results that are less than 80% of unaltered levels for future analyses.

3. Since the ecological flow approach(es) will be used as a screening tool for planning, it is preferable to establish criteria that if in error, are on the side of ecological flows that are slightly too high – a "false positive". Ecological flow criteria that are too low ("false negatives") are undesirable because if there is an error that is discovered during a site specific study for a proposed project, there would be much less lead time remaining for a water system to develop options to meet increasing water supply demands.

4. The table below indicates which of the 15 flow scenarios analyzed so far, by season, should continue to be evaluated.

Trial Balloon 4-12-2012

FLOW REGIME	Spring Apr-Jun	Summer Jul - Sept	Fall Oct - Nov	Winter Dec - Mar
Minimum Flow				
Annual 7Q10				
Monthly 7Q10				
September Median		KEEP	KEEP	
Monthly Median	KEEP	KEEP	KEEP	KEEP
Percentage of Mean Annual Flow				
10%				

20%		KEEP	KEEP	
30%		KEEP	KEEP	
40%	KEEP	KEEP	KEEP	KEEP
50%	KEEP	KEEP	KEEP	KEEP
60%	KEEP	KEEP	KEEP	KEEP
Percentage of Inflow				
70%	KEEP	KEEP	KEEP	KEEP
75%	KEEP	KEEP	KEEP	KEEP
80%	KEEP	KEEP	KEEP	KEEP
85%	KEEP	KEEP	KEEP	KEEP
90%	KEEP	KEEP	KEEP	KEEP

Following the discussion of the trial balloon, the small groups would report on both the combined sites by season discussions as well as their responses to the trial balloon.

XI. Small Group Report Out: All Sites Combined By Season and Assessment of the Trial Balloon

The facilitator provided the small groups with a format for reporting out. Each group would provide their responses to the 6 questions on the exercise involving all sites combined by season, followed with a brief group discussion. During the remaining time, the group would report on their reflections and deliberations about the trial balloon, followed with larger group discussion.

The six questions posed to the group follow:

1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?
2. Compare the 15 flow scenarios. Any broad conclusions?
3. Compare <80% and >120 % tables. Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?
4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.
5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep versus 11 shallow?
6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get a different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

Discussions of All Sites Combined by Season – Group 1-4 Report Out

Group 1 – Spring Judy reported

1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?

With all sites combined, we felt like spring protected the shallow guilds. Thus you would combine it without being overly concerned with your small weighted usable area.

2. Compare the 15 flow scenarios. Any broad conclusions?

   Spring is remarkably comparable with spring.

3. Compare <80% and >120 % tables. Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?

   For the analysis, we believe you could make reasonable recommendations just based on the 80%. However, by and large…well, we did not reach consensus within our group about the significance of the 120% level of analysis. Some folks wanted to keep it because they felt like we don't have enough classes analyzed or enough sites analyzed to know how important that 120% aspect might be down the road.

4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.

   We felt like a more refined analysis that's breaking out the individual guilds would support the stakeholder decision-making process later on. We thought people would be interested to know that level of detail at some point. So it'd be hard to drop it. We felt, though, like we [the EFSAB] could make reasonable recommendations, as a group, without it, but that would be something that the larger stakeholder groups would be interested in.

5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep versus 11 shallow?

   Felt like we would probably end up with the same prescription in springtime regardless of whether it was the deep or shallow guilds. The preferred scenarios would come out to be the same.

6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

   In spring, there did seem to be differences for some of the scenarios

Group 2 – Summer Chris reported

1. Contrast between small WUA and not small and assess how that influences the comparison of different flow scenarios and whether a scenario is desirable or not. Is having the striped versus not-striped areas of the bars significant in assessing the 15 flow scenarios?

   For the small WUA versus large we noted for the shallow guilds a smaller proportion of those guilds were made up by the small component. At the left end, the annual 7Q10, for example, about 20% of it was made up by the small. For the deep guild group, a third of them were comprised of the small, but as you move to the right on the flow scenarios, the large generally drops out completely.

2. Compare the 15 flow scenarios. Any broad conclusions?

   Looking at the total size of the bar, for the deep, most of those flow scenarios aren't really probably acceptable and wouldn't make it. We used 20% or 25% on the Y-axis as a general cutoff. For the shallow, a lot more made it; viewing overall, the height of those bars across the board drops for shallow versus the deep.

3. Compare <80% and >120 % tables. Do these charts show the same trend? Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?

Comparing the trends for the two graphs for the shallow generally provided the same information. For the deep, the trends were not the same. So for shallow, you could glean similar information off <80% or >120%. (but probably for different reasons). For the deep, the trends weren't similar (see further response on 120)

4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.

Which guilds stand out? Do some guilds not even show up in the analysis? In other words, are there some sites where the particular guild is not even in certain streams? It's showing up in the summing up of the total numbers. For the shallow guild group, the shallow fast guilds were fairly consistently contributing to a good portion of the height of the bar. So that would be the blue, orange, and olive green.

On the deep guilds, we didn't see obvious stand out. Since they all contributed, difficult to pick something.

5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep guilds/species versus 11 shallow guilds/species?

The deep appeared to be more sensitive consistently to flow scenarios than the shallow did. So using that 20% or 25% target on the Y-axis, six out of the fifteen scenarios would be less than that 20% on the Y-axis for the deep, while eleven of the fifteen would meet that target for the shallow.

6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get a different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

Small flashies were more sensitive, but then the opposite was the case for those flow scenarios in the middle. Given only four data points, we reserved judgment to see if something else pops up.

Group 3 – Fall Jeff reported

1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?

Wasn't a lot of need to break out the small usable area groups except in the certain flow regimes where that was the only group that seemed to show impact. And so it would be important to keep it in, in that regard.

2. Compare the 15 flow scenarios. Any broad conclusions?

About seasonality.

3. Compare <80% and >120 % tables. Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?

Looked at relative to the different guilds and broke it out that way. For Fall, the deep water preference guilds probably were not worth doing from our perspective. However, the shallow water guilds showed a little more definitive results for these guilds. Useful. Probably not critical but still useful and they do still help to describe the impact of the various approaches to flow management. We liked this particular plot. We felt like there

was considerable difference between the streams within classes that showed up in this plot. And so at this point in time, it was important to see that difference. For the shallow preferring guilds, it was more useful to keep those in than the deep water preferring guilds for the fall.

At the 80% for habitat impact, at or below 80%, all of the analyses were going to be useful, and they should be retained.

4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.

   Next question is whether or not there were certain guilds that represented a disproportionate amount of impact. We don't think there were any in the fall that were disproportionately represented or showed a disproportionate amount of impact in the fall season.

   They were all…there were none that really…There we go. If we were looking for something that if they accounted for 30, 40, 50% of the impact, we probably would have said yes those guilds are important to evaluate separately and leave out the rest, but we didn't see that effect. So we said probably just leave them all in as they are.

5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep versus 11 shallow?

   Basically the deep guilds that preferred the deeper water flow scenarios or deeper water flow habitats are less impacted under any approach to management that you might use than the shallow preferring guilds. And at <80% habitat the impacts were more pronounced, and they were different for different streams within a class when broken out. So basically the deep water groups were less impacted under any flow regime looked at. In comparing the two classes, our consensus was pretty simple.

6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get a different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

   Considering the discussion and analysis reviewed this morning where you had such a great difference between groups within a class, we believe it is too soon to even consider this question particularly as to whether or not to look at the particular difference between the classes when we've got such a difference within classes still existing. So until we resolve that, perhaps further refining how the classes are going to be organized, it's too soon to go that direction.

Group 4 – Winter Bob reported

1. Compare and contrast small usable areas (WUA) with not small usable areas. How does it affect your thinking of the 15 flow scenarios?

   It seems that the deep guilds were affected more than the shallow guilds and the low were more sensitive than the non-low WUA to less or at the lesser end of the flow restrictions.

2. Compare the 15 flow scenarios. Any broad conclusions?

   The least impacts were noted for the range associated with the percent of inflow as flow by. We do not know however, what the flows are in jumping across lines, across the three groups of restrictions, so that the 70% percentage of inflow as flow by may in fact be far less than the 60% percentage average flow as a minimum flow. There's a tendency when you

look at these graphs to think that it's all sort of going from more restriction to less restriction, but in fact we don't know where that jump is between those last two groups. At some point think about actually including the flow, some average flow or some flow measure if we want to make those kinds of comparisons.

3. Compare <80% and >120 % tables. Does one tell more than another? Does one influence your thinking about the 15 flow scenarios?

   The greater than 120% effects were far less predictable than the less than 80% effects, especially at the smaller flow alterations. The effects of 120% can be much greater than the less than 80%, at least for the shallow group and not necessarily for the deep group. In fact, in comparing, if you add the two groups together, think when we talk about dropping <80 or not…or >120 or not. In considering the difference between combining the two categories or just looking at the less than 80 for the middle range, it's important to note that for 60% of the average flow it was 7% if you just looked at the less than 80, up to 55% if you included both.

4. Think about the 19 guilds/species – are there any that are most affected at that site? Assess for your season, the significant differences between these.

   One thing we noted was, first of all, the garter seemed to be a very sensitive group. But secondly, that the fish tended to be more sensitive than the vertebrates in the shallow grouping. Or at least the bugs were more sensitive only at the higher alterations and not at the lower alterations.

5. Compare and contrast all 15 flow scenarios. When you look across them, is there a difference when using the 8 deep versus 11 shallow?

   Shallow versus deep. It says that the deep guilds are more impacted at the small alterations in flow but the shallow guilds are more impacted at the larger alterations in flow, especially for the percent average flow group of scenarios.

6. Contrasting between Class B (small/stable) and Class D streams (small/flashy), do you get different opinion about the different flow scenarios (recognizing that this is a limited number of data points)?

   There's an interesting hierarchical issue here, and that is the…a particular river at a particular season, this is comparing guilds, is going to either have a guild in the low WUA or the high WUA category and not both. So really what you're looking at is the interpretation has to be rivers with guilds with low category tended to be more sensitive than rivers where those guilds were in the high WUA category. It's a little bit different interpretation than when you're only working with one river. Flash versus stable--again, we had reservations as everyone else from dealing with so few. In most scenarios the small flashy streams are more sensitive than the small stable streams, at least in wintertime. I think that covered all the questions.

Questions (Q) or Comments (C) of Clarification:

Q: Question for Jeff, if I can recall how you stated it, something about deeper flow versus management – I think I might have drawn the opposite conclusion to that. What am I missing here? What's the one on the left there? Is that deep?

R: The one on the left is deep, the one on the right is shallow.

C: What I would say is that those deep guilds are more sensitive

R: Ok- though we weren't looking at these graphs. We had a different set of graphs that we were looking at. The deep flow guilds showing…those that were impacted that had over 120%.

C: One thing that stood out was when Bob made the last point about small flashy seemed to be responding more strongly to water withdrawal with the different scenarios than the small stable. Our group, which was the fall, found the opposite so I think that's interesting that across seasons that relationship, with its limitations of sample size, are showing really qualitatively different responses.

C: These types of graphs represent the number of guilds that are…have "significant" alteration. Would there be any use in developing a threshold concept to having graphs that show the number of… I don't know if it would be complete inverse of what we're already looking at.

C: I think what we're looking at is the [inaudible] of the percentage of area of each guilds that is diminished at least at the less than 80%. There is a percentage of guilds that have a percentage reduction of more than 20%. What I was talking about on the Y-axis…I think that's kind of what you're getting at. Do we need to start talking about what threshold across the board is? Or is it too early for that?

C: Jim, do you have a reaction or any comments for Judy?

R: If you go to this table, this is for all sites combined. It's not split up by class. You can get a numerical picture. Just for example, this guild…each whole number…you know, this means that for Annual 7Q10 in the fall, one site out of eight had less than 80% natural. So that's also a one but it was a small amount of habitat.

R: : Looking for generalities on the report out of questions 1-6:

- For question 6, seems like everyone had some reservation
- For question 5, the generality might be made that eight deep guilds and 11 shallow vary by season.
- For question 4 which gets into particular guilds most frequently affected at the site or does that hold true for that season? The generality is that it was pretty tough to come up with something within five minutes; need more time to dig into it question 4.
- For question 3 –see response to the Trial Balloon
- For question 2 – not clear
- For question 1 – That a fairly sensitive measure of impact would be lower withdrawal rates. And so if you didn't have that you might not be able to perceive those impacts until you'd had larger withdrawal rates.

There are some responses where it may take additional time to work through, like question 4.

Discussions about Trial Balloon Question 2

Group 1 – Spring

1. Reason for some wanting to keep 120 and others not.

C: Goes back to what Bob's already raised. The criteria for non-effect, so to speak, from withdrawal is a band that ranges from 80 to 120. Above that, the 120 is an impact. Below that, 80 is an impact. To drop one or the other is essentially to drop an impact. So I think that you really need to put both

of those together. Rather than say drop the 120 because there's not as many >120's as there are < 80's, they should be combined as an aggregate measure. Otherwise, you're underestimating the effects. That led to an interesting discussion about whether some of these flow metrics are linked together and whether there is double accounting because if flow drops and one changes, changes to something else, is this going to drop or is this going up.

C: It's such a complicated system that we may need that when we're accounting for some things. And that's where I think we couldn't reach consensus because we could never figure out if they were independent of one another. If they are not, then you can drop them.

C: I would say I'm in favor of dropping the 120 because from a historical perspective, we're looking at losses of flow so that side above 120. From a decision-making point of view and this process, I thought it was…I think…most decisions would be made on the bottom side of that scale of it and the bottom does change.

C: Yeah, you get an increase if you drop deep to shallow. You get an increase in shallow, so you're still withdrawing water. But more shallow is going to show up so it expands.

Group 2 – Summer

Leave as is.

Group 3 – Fall

Pretty much reached consensus that it was okay to take out the 120% and above group because it didn't seem to have as much impact as the 80% or below. It didn't show up very often and it didn't seem to respond as much, plus we were trying to wrestle with the idea of how negative is the creation of more habitat in certain categories. Another question we bounced around is, was that truly a negative impact or not. We split it out by deep- and shallow-preferring guilds as well.

C: Can I just say one comment to that? You're shifting the community then. Yes, you are…the creation of some of the habitat or addition might not be seen as a total negative but you are shifting community dynamics.

C: You should be picking up on that in the loss. So with it less than 80%, presumably if you're creating habitat for some, you're increasing it someplace else. That's right. That's a great point that you made, that we need to try to better understand to what degree these things are linked.

Group 4 – Winter

We covered very much what others said. But if it is a balancing act (less than 80% is balanced by greater than120%) you could expect the percentages should be similar, but they were not for winter. The percentage of loss for < 80% was 7% under one condition, whereas it was about 43% for the >120%. In another case, it was 15% for the <80% and about 45% for the >120%. So there are really major differences in percentage that I'm sure there is some swapping off. But it doesn't come out as equal percentages the way we're doing the habitat analysis. Thus we recommend keeping 120 in the mix.

Comment (C), Questions (Q), and Response (R):

R: Am I right in perceiving that the fall and summer groups are a little more inclined that above 120% is not that useful, but the winter and spring groups feel it's more important to continue and keep 120? That's interesting and may actually be on point. With fall and summer, chances are you're not going to make things better for anybody because you're already at a low amount of water, or lower in the summer and the fall season. In winter and spring, you're getting some or worse because you're starting from a higher availability of water. So I think you're both right. I mean, in a particular season, the 120 may not tell you as much. But in those seasons when water is a little more available, the winter and the spring, you're getting those mixed results happening

where you're seeing habitat for some and diminishing it for others. It may be the shallow/deep thing.

Q: But the conversation we just had about Tom and Cat's point of view, we don't know if that's a tradeoff really or not. How are those two things linked? Are we really creating habitat or not?

C: And I would say the safe way to interpret is not whether its positive or negative but it's purely an analysis of alteration. You are significantly altering the relative abundance of some habitat. You are significantly altering the presence of the other one. So if you have significant alteration, it needs to be analyzed. And if you don't, you can drop it.

Discussions about Trial Balloon Question 4 (Responses to Question 3 Follow)

Group 1 – Spring

Unable to dive into a review. For the most part, we were satisfied with the level of change, as far as the keeps. We were comfortable keeping what you all decided for this proposal. For 70% of the inflow we thought there was pretty good evidence that that really wasn't going to be suitable. But go ahead and leave it in. Is anybody disagreeing with what I'm saying? And then I think there was still concern, kind of like if you keep some in some seasons and drop them in other seasons, are we going to wish we hadn't later? Similar to our guilds. How comfortable would we be dropping guilds for one season and not another and don't we just want to have comparable data across the board? [Especially for something like September median]? . We were approaching it the other way. It's like should we drop it in order to be the same as y'all? We decided not to because you were looking at it the other way, maybe adding it back. Just for consistency across…

Group 2 – Summer

The initial reaction was to also drop September median, and 20% and 30% of the annual flow. But upon further reflection, we thought it too early to drop them for two reasons. One was, if we start chopping out too much too soon, there is the potential to lose break points or trends that would help us to find out where things are really happening (as Jamie brought up). Because of the big differences we've seen between Class B and D, they're reacting very differently for those flow scenarios and thus, we cannot say that they should be dropped. We ended up with that column, leave it the way it is.

Group 3 – Fall

We pretty much agreed with the recommendation of the ones to leave out for the fall, which were the two median flows and the 10%. One caveat, we would recommend for the board to analyze, once the issue of classifications and some other questions are resolved, to go back and add in the 7Q10 figures for historical comparisons - because that's what's been used so often in the past. It's going to have to be a good marking point in order to get someone to accept the other metrics.

Group 4 – Winter

We were comfortable with the list for winter with the reservation that others have pointed out, if you want to have an annual picture then you should either drop the others or add some. But for winter itself, what you have is probably acceptable.

Comments about Trial Balloon Question 3 (general reactions from the large group)

Is it better to err on the side of the bar being high or is that something else; do you have any initial thoughts on that?

Is it better to err on the side of the bar being high or is that something else; do you have any initial thoughts on that?

R: Something that came out…I was at a Wildlife Society Meeting in Athens last week and they were talking about ecological flows, climate change, and environmental services. One of the things that just came up was if the bar is high, if the environmental flow is such that it puts communities into a panic, this may increase the need for building more reservoirs. Meaning if we need to maintain this level of flow, we will need a reservoir to do it since a withdrawal scenario will not provide it. What can we take from this discussion? Anything precautionary we need to be mindful of?

C: I think Jim covered it well when he talked about this being a screening tool. Being set too high simply kicks you into another site-specific mode. It's a whole lot cheaper to pump water into another lake than it is to try to build the eco system (or reservoir).

C: By setting the 80% boundary, in a way you have already established to some extent what that policy's going to be. I don't think we really had that discussion, but good to throw it out there. Does that mean that there's still a lot of wiggle room between that zero to eighty.

R: We haven't set it to zero; we haven't set it to a 30% change.

Summary:

What I've just heard is helpful because your points about keeping in mind for groups beyond this board, having the same set of flow alternatives for all seasons, and at some point having a 7Q10 there. Maybe not for every bit of output you all crank through between now and whenever. But at the end, when the final summation – whether it's a report or whatever – comes out of this, others beyond this group may find it useful having a 7Q10 included. As Jeff pointed out, it has some institutional standing. By season, I heard you all say that what is in the proposal is ok.

Again, I'll just reiterate that those two seasons of low water make sense off the top of my head. The two seasons with lower water availabilities and at the above 120 just not showing much. So the two of them make sense.

XII. Next Meeting & Directions

The next meeting for the EFSAB was scheduled for May 29. Due to other activities scheduled around or on that date (the May 29 NC Nutrient Forum which some EFSAB members will attend and it follows Memorial Day weekend), the facilitator proposed that the EFSAB skip the May 29 meeting and have the next meeting on June 19 at the Archdale Building in Raleigh. The EFSAB agreed to that proposal with the understanding that the meeting would be tentatively scheduled for 9:45am to 4:15pm **[since changed to 10:30 – 4:30]**, with the final schedule to be determined upon finalizing the agenda for the meeting.

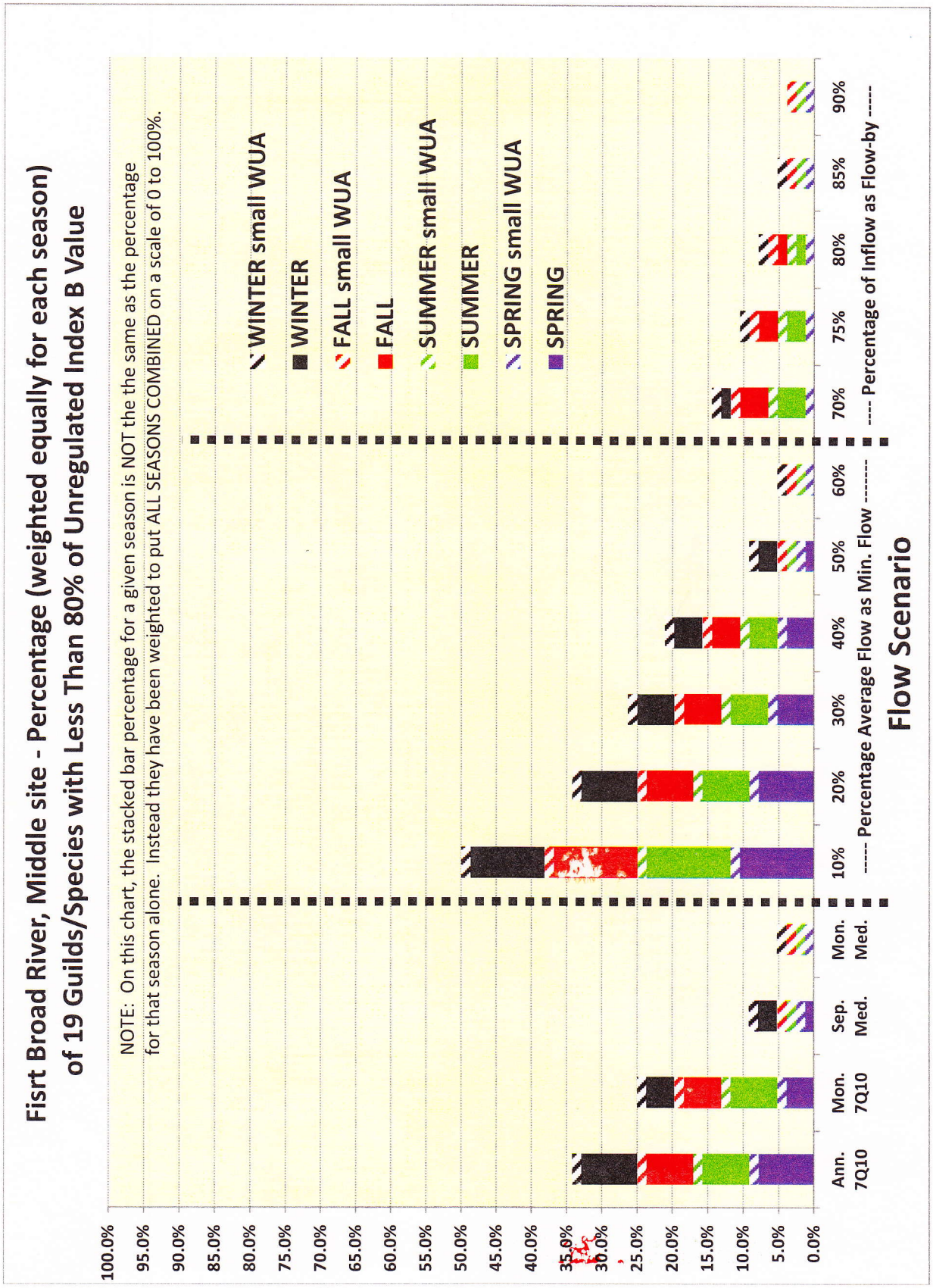
The group then discussed the pros and cons of various meeting venues and agreed to hold the meetings at the Stan Adams Training Center, Jordan Lake when available.

The facilitator then asked that EFSAB members write proposed future agenda items on cards and give them to the facilitators. Jim added that if, after this meeting, people think of items they would like discussed at the meeting in June, send an email by May 5 to either the facilitators or Jim.

On June 19, 2012 we will meet from **10:30 -4:30pm** in the hearing room at the Archdale Building, 512 North Salisbury St., Raleigh, NC 27604

map to Archdale Building

APPENDIX 1



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APPENDIX 2

FIRST BROAD, MIDDLE

If seasonal Index B value is < 80% of unregulated value, and seasonal unregulated Index B >= 1000, then table shows a "1".
If seasonal Index B value is < 80% of unregulated value, and seasonal unregulated Index B< 1000, then table shows a "0.01".

Season	SPRING

April - June

Numbers in Red indicate low amount of habitat (seasonal unregulated index B < 1,000).

Guild		Traditional Minimum Flow				Percent Mean Annual Flow						Percent Flow-by					unregulated Index B
		Ann. 7Q10	Mon. 7Q10	Sep. Med.	Mon. Med.	10%	20%	30%	40%	50%	60%	70%	75%	80%	85%	90%	
Shallow	SSYOY																1512
	SSVEG																7774
	SSWOOD																7774
	SSCOARSE																364
	SSFINENC																8778
	SFLOWVEL																523
	SFMODVEL					1											3422
	SFHIVEL	1	1			1	1	1	1								1462
Deep	DSCOV	1	1			1	1	1	1								3811
	DSCOV2																6824
	DSNC					1											4941
	DFFINE	1				1	1	1									11788
	DFGRCOB	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	345
	DFCOARSE	1	1	1		1	1	1	1	1							22017
Other	AMSS2	1				1	1										34224
	ROBRHS																
	GORHA	1				1	1										2206
	GORHJ	1				1	1										2409
	AMSS4																
	EPHEM																13248
	PLECO																4587
	TRIC1																14276
	MACLR																21516
Total out of 19		6.01	3.01	1.01	0.01	8.01	6.01	4.01	3.01	1.01	0.01	0.01	0.01	0.01	0.01	0.01	
total > 1000 WUA		6	3	1	0	8	6	4	3	1	0	0	0	0	0	0	
total < 1000 WUA		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Total out of 19		7	4	2	1	9	7	5	4	2	1	1	1	1	1	1	
% for just this season		36.8%	21.1%	10.5%	5.3%	47.4%	36.8%	26.3%	21.1%	10.5%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	
% weighted equally for each season		9.2%	5.3%	2.6%	1.3%	11.8%	9.2%	6.6%	5.3%	2.6%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	
% > 1000 WUA		7.9%	3.9%	1.3%	0.0%	10.5%	7.9%	5.3%	3.9%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
% < 1000 WUA		1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	

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APPENDIX 3

FIRST BROAD, MIDDLE Table shows percentage of unregulated Index B value achieved by flow scenario

Season **SPRING** April - June Highlighted cells are those >120% or < 80%

Guild		Traditional Minimum Flow				Minimum = Percent Mean Annual Flow						Percent Flow-by				
		Ann. 7Q10	Mon. 7Q10	Sep. Med.	Mon. Med.	10%	20%	30%	40%	50%	60%	70%	75%	80%	85%	90%
Shallow	SSYOY	114.2%	152.1%	157.5%	115.8%	163.0%	113.5%	139.0%	162.4%	157.2%	135.4%	128.9%	124.5%	119.7%	114.9%	109.8%
	SSVEG	217.7%	145.9%	122.6%	105.4%	288.0%	209.1%	164.3%	137.8%	122.5%	114.2%	118.6%	114.7%	111.2%	108.1%	105.2%
	SSWOOD	217.7%	145.9%	122.6%	105.4%	288.0%	209.1%	164.3%	137.8%	122.5%	114.2%	118.6%	114.7%	111.2%	108.1%	105.2%
	SSCOARSE	1134.3%	356.0%	260.2%	98.6%	1475.3%	920.6%	432.4%	335.4%	260.2%	154.9%	183.0%	164.0%	147.0%	133.0%	120.3%
	SSFINENC	155.9%	114.3%	104.3%	103.1%	249.7%	148.2%	123.2%	109.8%	104.3%	103.7%	105.7%	104.5%	103.5%	102.5%	101.7%
	SFLOWVEL	804.0%	449.5%	308.8%	104.4%	759.7%	787.0%	561.0%	399.2%	308.2%	232.9%	235.4%	205.0%	178.4%	155.1%	134.4%
	SFMODVEL	118.4%	164.2%	165.4%	121.6%	70.9%	125.9%	161.7%	168.3%	165.3%	160.8%	138.3%	132.6%	126.6%	120.0%	113.4%
	SFHIVEL	14.5%	52.9%	80.4%	129.7%	3.6%	16.7%	34.6%	56.8%	80.5%	102.3%	85.8%	90.4%	93.9%	96.6%	98.4%
Deep	DSCOV	43.5%	53.7%	82.3%	105.0%	26.4%	43.5%	43.5%	43.5%	82.7%	102.7%	80.7%	84.8%	88.6%	91.8%	94.8%
	DSCOV2	107.3%	107.2%	102.6%	99.1%	84.7%	108.6%	110.1%	106.9%	102.6%	99.6%	102.0%	101.5%	101.1%	100.7%	100.4%
	DSNC	96.6%	141.3%	120.4%	102.6%	22.5%	105.4%	170.2%	125.9%	120.4%	115.5%	111.2%	109.1%	107.2%	105.3%	103.4%
	DFFINE	35.2%	90.0%	111.2%	105.4%	11.1%	40.0%	72.3%	98.2%	111.3%	112.6%	100.2%	100.9%	101.2%	101.2%	101.0%
	DFGRCOB	0.0%	0.0%	0.0%	64.6%	0.0%	0.0%	0.0%	0.0%	0.0%	22.3%	35.7%	43.8%	52.2%	60.6%	69.0%
	DFCOARSE	30.3%	61.3%	77.4%	97.6%	15.4%	32.8%	49.7%	64.9%	77.5%	86.6%	84.0%	87.4%	90.5%	93.3%	95.8%
Other	AMSS2	69.6%	97.1%	101.7%	101.7%	38.2%	73.8%	92.9%	99.8%	101.7%	102.7%	99.8%	100.1%	100.2%	100.3%	100.2%
	ROBRHS															
	GORHA	77.3%	90.3%	95.1%	99.0%	64.5%	78.7%	86.3%	91.6%	95.1%	97.0%	96.1%	96.9%	97.6%	98.3%	99.0%
	GORHJ	66.3%	91.7%	101.1%	103.2%	45.9%	69.1%	84.5%	94.9%	101.1%	104.3%	98.4%	99.1%	99.6%	99.9%	100.1%
	AMSS4															
	EPHEM	166.6%	155.2%	140.9%	107.7%	150.4%	167.6%	164.4%	153.6%	140.9%	128.4%	126.7%	121.7%	117.0%	112.5%	108.1%
	PLECO	164.3%	160.1%	137.6%	108.9%	119.4%	169.2%	176.6%	155.5%	137.5%	127.4%	127.2%	122.1%	117.2%	112.6%	108.2%
	TRIC1	105.5%	120.3%	119.6%	104.7%	87.6%	107.7%	119.3%	122.4%	119.6%	115.4%	110.7%	109.1%	107.3%	105.6%	103.7%
	MACLR	147.4%	135.3%	126.0%	105.7%	145.3%	147.0%	141.5%	133.8%	125.9%	118.7%	117.4%	114.2%	111.2%	108.2%	105.4%
AVERAGE		185.1%	137.3%	125.6%	104.3%	195.7%	174.9%	147.2%	133.3%	125.6%	116.7%	114.5%	111.5%	108.7%	106.1%	103.7%
MEDIAN		107.3%	120.3%	119.6%	104.7%	84.7%	108.6%	123.2%	122.4%	119.6%	114.2%	110.7%	109.1%	107.2%	105.3%	103.4%
MINIMUM		0.0%	0.0%	0.0%	64.6%	0.0%	0.0%	0.0%	0.0%	0.0%	22.3%	35.7%	43.8%	52.2%	60.6%	69.0%
MAXIMUM		1134.3%	449.5%	308.8%	129.7%	1475.3%	920.6%	561.0%	399.2%	308.2%	232.9%	235.4%	205.0%	178.4%	155.1%	134.4%

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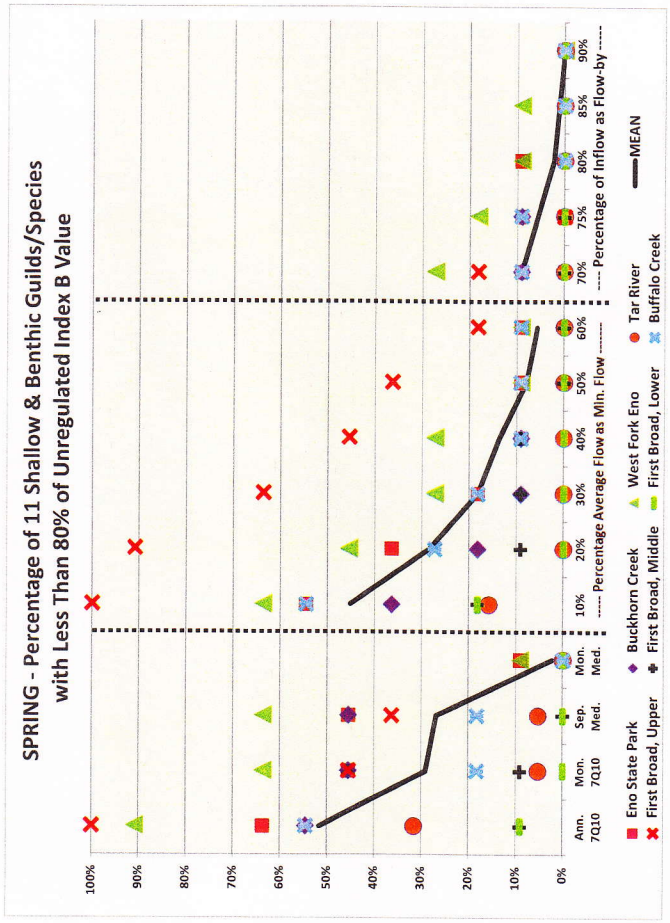
APPENDIX 4



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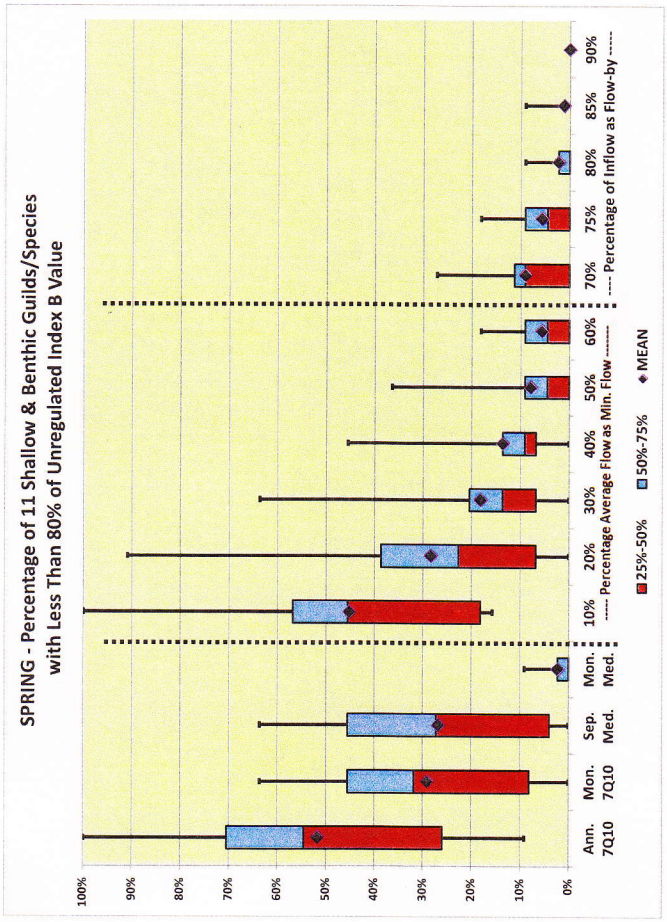
APPENDIX 5



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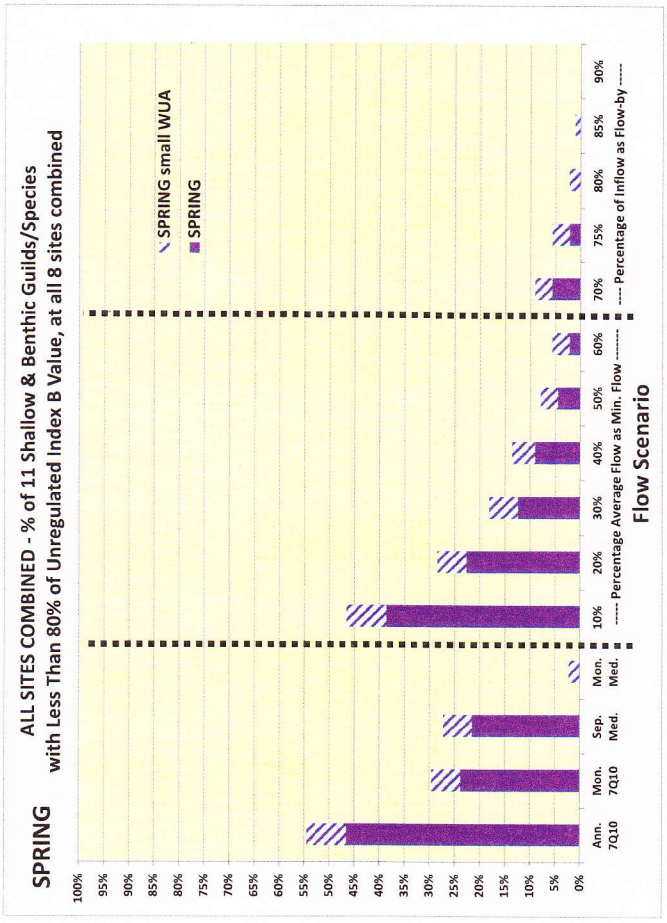
APPENDIX 6

All sites combined tally 1



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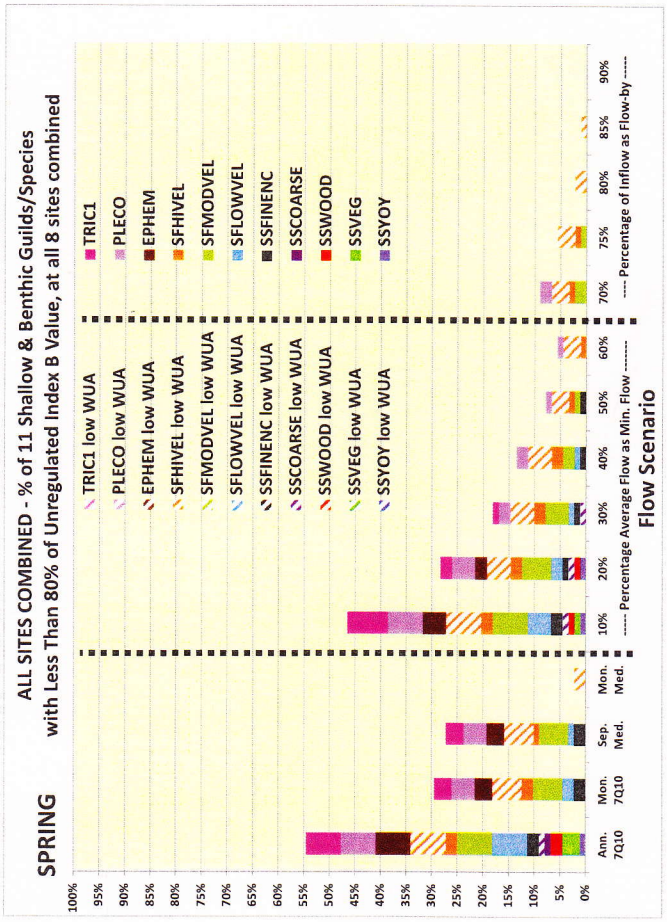
APPENDIX 7



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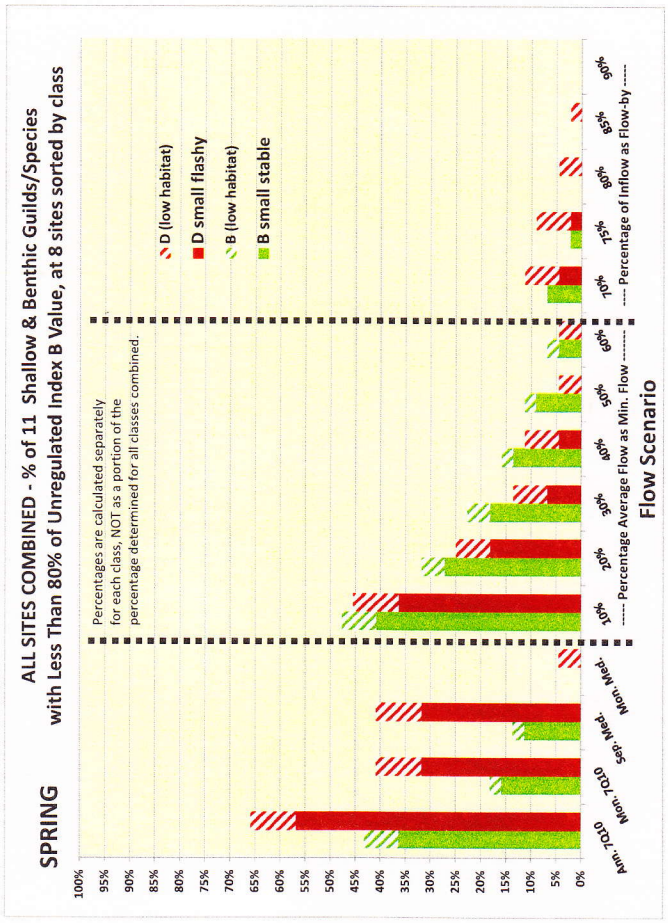
APPENDIX 8



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APPENDIX 9

NC Ecological Flows Science Advisory Board
DWR Trial Balloon - April 24, 2012

Notes:

- The approach(es) developed for determining ecological flows will be used as a screening tool in river basin models and plans.
- These models/plans will be used to assess water availability under current conditions and projected 20-year and 50-year water supply demands.
- Red flags raised by modeling/planning will allow water supply systems adequate time to plan for meeting future water needs.
- Specific project proposals and feasibility studies would still utilize site-specific studies to determine ecological flow needs.

Trial Balloon:

1. At this point in the work of the EFlows SAB, DWR is proposing that we focus on a smaller set of flow options for consideration. More analysis and review is needed before the SAB can consider a single ecological flow proposal.

2. The habitat modeling results have so far examined flow scenarios for habitat indices that are less than 80% or more than 120% of the habitat available under an unaltered flow regime. The differences between flow scenarios are less pronounced for results above the 120% threshold, and we propose that we focus on habitat results that are less than 80% of unaltered levels for future analyses.

3. Since the ecological flow approach(es) will be used as a screening tool for planning, it is preferable to establish criteria that if in error, are on the side of ecological flows that are slightly too high – a "false positive". Ecological flow criteria that are too low ("false negatives") are undesirable because if there is an error that is discovered during a site specific study for a proposed project, there would be much less lead time remaining for a water system to develop options to meet increasing water supply demands.

4. The table below indicates which of the 15 flow scenarios analyzed so far, by season, should continue to be evaluated.

Trial Balloon 4-12-2012

FLOW REGIME	Spring Apr-Jun	Summer Jul - Sept	Fall Oct - Nov	Winter Dec - Mar
Minimum Flow				
Annual 7Q10				
Monthly 7Q10				
September Median		KEEP	KEEP	
Monthly Median	KEEP	KEEP	KEEP	KEEP
Percentage of Mean Annual Flow				
10%				
20%		KEEP	KEEP	
30%		KEEP	KEEP	
40%	KEEP	KEEP	KEEP	KEEP
50%	KEEP	KEEP	KEEP	KEEP
60%	KEEP	KEEP	KEEP	KEEP
Percentage of Inflow				
70%	KEEP	KEEP	KEEP	KEEP
75%	KEEP	KEEP	KEEP	KEEP
80%	KEEP	KEEP	KEEP	KEEP
85%	KEEP	KEEP	KEEP	KEEP
90%	KEEP	KEEP	KEEP	KEEP

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Appendix 10: Small Groups Discussion on Fidelity Testing

The EFSAB and alternates divided up into 5 groups to have a discussion and report out answers to the following question: What additional questions and/or concerns do you have about the methodology used in the fidelity testing?

Group one:

1. Is there such a thing as an:
    - unaltered stream?
    - land use patterns
    - irrigation withdrawals
2. Concern: for two/three of the classes, we do not have biological data
    - use data from other sources if available and easily assessable
3. How do you account for sampling biases? (for example during a low flow year?)
4. Can we look at Konrad's classification? Is his paper ready for review?
5. What is the timeline for this process? (for Fidelity or the EFSAB- if latter, reference Tom Reeder's presentation)

Group 2

1. If classification relies on output from a particular tool (e.g., WaterFall) to determine class, will DWR have access to that tool?
2. Large river data lacking- may be available from FERC relicensing projects but for altered streams (Group 4 also posed the same solution for larger river systems)
3. Other (non-hydrologic) variables for classification need to be widely and easily applicable and available. For example, gradient could be important.

Group 3

1. Avoid circular thinking: where do we stop – biology, hydrology, biology, etc.
    - assemblage classes on biology, or then hydrologic - what is the stopping criteria
2. Need definitions:
    a. unaltered flow – how many water sources in areas with unaltered flow
    b. altered flow vs. unaltered (hydro) – buffer for defining what constitutes an alteration.
    c. reference sites for hydro vs. reference sites for bio
    d. tributary effects with distance
3. Criteria for site selection
    a. changes in biota over time
    b. changes in conditions over time
4. A prior flow condition, effects of preceding conditions of biology; need info on lag effects and how to incorporate this into site selection.
5. Time frame of analysis and reporting
6. Exploratory data analysis
7. Reference sites – definitions for hydrology and biology (fish and bugs)
8. Need to add additional parallel analysis that includes altered sites (hydrology) is/in existing hydro classification (e.g. Neuse above and below dam)

Group 4

1. Define community based assemblage vs. individual species response
2. Concern that smaller wadeable stream communities may show more sensitivity/difference relationships than larger rivers (*size factor)
3. For larger rivers not wadeable – will we have enough bio data to show fidelity? (*hydropower/utilities companies may be willing to share data from larger rivers – tap into FERC data)
4. Native vs. non-native species fish (whether to include non-natives in the analysis?)
5. Importance of physiography: hydrology – typology. If no fidelity does it mean it is incorrect or that they are not related?
6. Support approach of virtual gage data. It would help to have some input review from hydrologists
7. How does WaterFall address groundwater inflow and lag behind rainfall?

Group 5

1. Presence or absence of data species may not reflect communities and guilds appropriately. Density information would help.
2. Is what we are doing defensible regarding ecological integrity? This will be critical when legal issues come into play.
3. What are the effects of species abundancy refraction (?) curves on amount of sampling used for plus/minus information? (change in # of species with # of samples with different amounts of samples in different streams)
4. Potential data sets beyond the five introduced earlier in the Fidelity presentation?
    a. academic? Academic data sets may be valuable – eg- long-term data from 1 or 2 streams to get ideas of how things may work across other streams
    b. other agencies?
    c. value of long-term or intense for 1 or few systems to evaluate uncertainty of larger data set of data used.
5. What is the end game? If all works with this, how does it affect what Jim is doing? How does it contribute to what Jim is doing?

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